INSTALLATION AND OPERATION MANUAL

FCD-IP

E1/T1 or Fractional E1/T1 Access Unit with Integrated Router

Version 4.2

RAD
data communications
The Access Company

FCD-IP

E1/T1 or Fractional E1/T1 Access Unit with Integrated Router

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Installation and Operation Manual

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Product Disposal

To facilitate the reuse, recycling and other forms of recovery of waste equipment in protecting the environment, the owner of this RAD product is required to refrain from disposing of this product as unsorted municipal waste at the end of its life cycle. Upon termination of the unit's use, customers should provide for its collection for reuse, recycling or other form of environmentally conscientious disposal.

General Safety Instructions

The following instructions serve as a general guide for the safe installation and operation of telecommunications products. Additional instructions, if applicable, are included inside the manual.

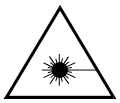
Safety Symbols

Warning

This symbol may appear on the equipment or in the text. It indicates potential safety hazards regarding product operation or maintenance to operator or service personnel.

Danger of electric shock! Avoid any contact with the marked surface while the product is energized or connected to outdoor telecommunication lines.

Protective ground: the marked lug or terminal should be connected to the building protective ground bus.



Warning

Some products may be equipped with a laser diode. In such cases, a label with the laser class and other warnings as applicable will be attached near the optical transmitter. The laser warning symbol may be also attached.

Please observe the following precautions:

- Before turning on the equipment, make sure that the fiber optic cable is intact and is connected to the transmitter.
- Do not attempt to adjust the laser drive current.
- Do not use broken or unterminated fiber-optic cables/connectors or look straight at the laser beam.
- The use of optical devices with the equipment will increase eye hazard.
- Use of controls, adjustments or performing procedures other than those specified herein, may result in hazardous radiation exposure.

ATTENTION: The laser beam may be invisible!

In some cases, the users may insert their own SFP laser transceivers into the product. Users are alerted that RAD cannot be held responsible for any damage that may result if non-compliant transceivers are used. In particular, users are warned to use only agency approved products that comply with the local laser safety regulations for Class 1 laser products.

Always observe standard safety precautions during installation, operation and maintenance of this product. Only qualified and authorized service personnel should carry out adjustment, maintenance or repairs to this product. No installation, adjustment, maintenance or repairs should be performed by either the operator or the user.

Handling Energized Products

General Safety Practices

Do not touch or tamper with the power supply when the power cord is connected. Line voltages may be present inside certain products even when the power switch (if installed) is in the OFF position or a fuse is blown. For DC-powered products, although the voltages levels are usually not hazardous, energy hazards may still exist.

Before working on equipment connected to power lines or telecommunication lines, remove jewelry or any other metallic object that may come into contact with energized parts.

Unless otherwise specified, all products are intended to be grounded during normal use. Grounding is provided by connecting the mains plug to a wall socket with a protective ground terminal. If a ground lug is provided on the product, it should be connected to the protective ground at all times, by a wire with a diameter of 18 AWG or wider. Rack-mounted equipment should be mounted only in grounded racks and cabinets.

Always make the ground connection first and disconnect it last. Do not connect telecommunication cables to ungrounded equipment. Make sure that all other cables are disconnected before disconnecting the ground.

Connecting AC Mains

Make sure that the electrical installation complies with local codes.

Always connect the AC plug to a wall socket with a protective ground.

The maximum permissible current capability of the branch distribution circuit that supplies power to the product is 16A. The circuit breaker in the building installation should have high breaking capacity and must operate at short-circuit current exceeding 35A.

Always connect the power cord first to the equipment and then to the wall socket. If a power switch is provided in the equipment, set it to the OFF position. If the power cord cannot be readily disconnected in case of emergency, make sure that a readily accessible circuit breaker or emergency switch is installed in the building installation.

In cases when the power distribution system is IT type, the switch must disconnect both poles simultaneously.

Connecting DC Power

Unless otherwise specified in the manual, the DC input to the equipment is floating in reference to the ground. Any single pole can be externally grounded.

Due to the high current capability of DC power systems, care should be taken when connecting the DC supply to avoid short-circuits and fire hazards.

DC units should be installed in a restricted access area, i.e. an area where access is authorized only to qualified service and maintenance personnel.

Make sure that the DC power supply is electrically isolated from any AC source and that the installation complies with the local codes.

The maximum permissible current capability of the branch distribution circuit that supplies power to the product is 16A. The circuit breaker in the building installation should have high breaking capacity and must operate at short-circuit current exceeding 35A.

Before connecting the DC supply wires, ensure that power is removed from the DC circuit. Locate the circuit breaker of the panel board that services the equipment and switch it to the OFF position. When connecting the DC supply wires, first connect the ground wire to the corresponding terminal, then the positive pole and last the negative pole. Switch the circuit breaker back to the ON position.

A readily accessible disconnect device that is suitably rated and approved should be incorporated in the building installation.

If the DC power supply is floating, the switch must disconnect both poles simultaneously.

Connecting Data and Telecommunications Cables

Data and telecommunication interfaces are classified according to their safety status.

The following table lists the status of several standard interfaces. If the status of a given port differs from the standard one, a notice will be given in the manual.

Ports	Safety Status	
V.11, V.28, V.35, V.36, RS-530, X.21, 10 BaseT, 100 BaseT, Unbalanced E1, E2, E3, STM, DS-2, DS-3, S-Interface ISDN, Analog voice E&M	SELV	Safety Extra Low Voltage: Ports which do not present a safety hazard. Usually up to 30 VAC or 60 VDC.
xDSL (without feeding voltage), Balanced E1, T1, Sub E1/T1	TNV-1	Telecommunication Network Voltage-1: Ports whose normal operating voltage is within the limits of SELV, on which overvoltages from telecommunications networks are possible.
FXS (Foreign Exchange Subscriber)	TNV-2	Telecommunication Network Voltage-2: Ports whose normal operating voltage exceeds the limits of SELV (usually up to 120 VDC or telephone ringing voltages), on which overvoltages from telecommunication networks are not possible. These ports are not permitted to be directly connected to external telephone and data lines.
FXO (Foreign Exchange Office), xDSL (with feeding voltage), U-Interface ISDN	TNV-3	Telecommunication Network Voltage-3: Ports whose normal operating voltage exceeds the limits of SELV (usually up to 120 VDC or telephone ringing voltages), on which overvoltages from telecommunication networks are possible.

Always connect a given port to a port of the same safety status. If in doubt, seek the assistance of a qualified safety engineer.

Always make sure that the equipment is grounded before connecting telecommunication cables. Do not disconnect the ground connection before disconnecting all telecommunications cables.

Some SELV and non-SELV circuits use the same connectors. Use caution when connecting cables. Extra caution should be exercised during thunderstorms.

When using shielded or coaxial cables, verify that there is a good ground connection at both ends. The grounding and bonding of the ground connections should comply with the local codes.

The telecommunication wiring in the building may be damaged or present a fire hazard in case of contact between exposed external wires and the AC power lines. In order to reduce the risk,

there are restrictions on the diameter of wires in the telecom cables, between the equipment and the mating connectors.

Caution To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cords.

Attention Pour réduire les risques s'incendie, utiliser seulement des conducteurs de télécommunications 26 AWG ou de section supérieure.

Some ports are suitable for connection to intra-building or non-exposed wiring or cabling only. In such cases, a notice will be given in the installation instructions.

Do not attempt to tamper with any carrier-provided equipment or connection hardware.

Electromagnetic Compatibility (EMC)

The equipment is designed and approved to comply with the electromagnetic regulations of major regulatory bodies. The following instructions may enhance the performance of the equipment and will provide better protection against excessive emission and better immunity against disturbances.

A good ground connection is essential. When installing the equipment in a rack, make sure to remove all traces of paint from the mounting points. Use suitable lock-washers and torque. If an external grounding lug is provided, connect it to the ground bus using braided wire as short as possible.

The equipment is designed to comply with EMC requirements when connecting it with unshielded twisted pair (UTP) cables. However, the use of shielded wires is always recommended, especially for high-rate data. In some cases, when unshielded wires are used, ferrite cores should be installed on certain cables. In such cases, special instructions are provided in the manual.

Disconnect all wires which are not in permanent use, such as cables used for one-time configuration.

The compliance of the equipment with the regulations for conducted emission on the data lines is dependent on the cable quality. The emission is tested for UTP with 80 dB longitudinal conversion loss (LCL).

Unless otherwise specified or described in the manual, TNV-1 and TNV-3 ports provide secondary protection against surges on the data lines. Primary protectors should be provided in the building installation.

The equipment is designed to provide adequate protection against electro-static discharge (ESD). However, it is good working practice to use caution when connecting cables terminated with plastic connectors (without a grounded metal hood, such as flat cables) to sensitive data lines. Before connecting such cables, discharge yourself by touching ground or wear an ESD preventive wrist strap.

FCC-15 User Information

This equipment has been tested and found to comply with the limits of the Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the Installation and Operation manual, may cause harmful interference to the radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canadian Emission Requirements

This Class A digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulation.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Warning per EN 55022 (CISPR-22)

Warning	This is a class A product. In a domestic environment, this product may cause radio interference, in which case the user will be required to take adequate measures.
Avertissement	Cet appareil est un appareil de Classe A. Dans un environnement résidentiel, cet appareil peut provoquer des brouillages radioélectriques. Dans ces cas, il peut être demandé à l'utilisateur de prendre les mesures appropriées.
Achtung	Das vorliegende Gerät fällt unter die Funkstörgrenzwertklasse A. In Wohngebieten können beim Betrieb dieses Gerätes Rundfunkströrungen auftreten, für deren Behebung der Benutzer verantwortlich ist.

Mise au rebut du produit

Afin de faciliter la réutilisation, le recyclage ainsi que d'autres formes de récupération d'équipement mis au rebut dans le cadre de la protection de l'environnement, il est demandé au propriétaire de ce produit RAD de ne pas mettre ce dernier au rebut en tant que déchet municipal non trié, une fois que le produit est arrivé en fin de cycle de vie. Le client devrait proposer des solutions de réutilisation, de recyclage ou toute autre forme de mise au rebut de cette unité dans un esprit de protection de l'environnement, lorsqu'il aura fini de l'utiliser.

Instructions générales de sécurité

Les instructions suivantes servent de guide général d'installation et d'opération sécurisées des produits de télécommunications. Des instructions supplémentaires sont éventuellement indiquées dans le manuel.

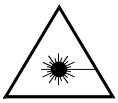
Symboles de sécurité

Avertissement

Ce symbole peut apparaitre sur l'équipement ou dans le texte. Il indique des risques potentiels de sécurité pour l'opérateur ou le personnel de service, quant à l'opération du produit ou à sa maintenance.

Danger de choc électrique ! Evitez tout contact avec la surface marquée tant que le produit est sous tension ou connecté à des lignes externes de télécommunications.

Mise à la terre de protection : la cosse ou la borne marquée devrait être connectée à la prise de terre de protection du bâtiment.



Avertissement

Certains produits peuvent être équipés d'une diode laser. Dans de tels cas, une étiquette indiquant la classe laser ainsi que d'autres avertissements, le cas échéant, sera jointe près du transmetteur optique. Le symbole d'avertissement laser peut aussi être joint.

Veuillez observer les précautions suivantes :

- Avant la mise en marche de l'équipement, assurez-vous que le câble de fibre optique est intact et qu'il est connecté au transmetteur.
- Ne tentez pas d'ajuster le courant de la commande laser.
- N'utilisez pas des câbles ou connecteurs de fibre optique cassés ou sans terminaison et n'observez pas directement un rayon laser.
- L'usage de périphériques optiques avec l'équipement augmentera le risque pour les yeux.
- L'usage de contrôles, ajustages ou procédures autres que celles spécifiées ici pourrait résulter en une dangereuse exposition aux radiations.

ATTENTION : Le rayon laser peut être invisible !

Les utilisateurs pourront, dans certains cas, insérer leurs propres émetteurs-récepteurs Laser SFP dans le produit. Les utilisateurs sont avertis que RAD ne pourra pas être tenue responsable de tout dommage pouvant résulter de l'utilisation d'émetteurs-récepteurs non conformes. Plus particulièrement, les utilisateurs sont avertis de n'utiliser que des produits approuvés par l'agence et conformes à la réglementation locale de sécurité laser pour les produits laser de classe 1.

Respectez toujours les précautions standards de sécurité durant l'installation, l'opération et la maintenance de ce produit. Seul le personnel de service qualifié et autorisé devrait effectuer l'ajustage, la maintenance ou les réparations de ce produit. Aucune opération d'installation, d'ajustage, de maintenance ou de réparation ne devrait être effectuée par l'opérateur ou l'utilisateur.

Manipuler des produits sous tension

Règles générales de sécurité

Ne pas toucher ou altérer l'alimentation en courant lorsque le câble d'alimentation est branché. Des tensions de lignes peuvent être présentes dans certains produits, même lorsque le commutateur (s'il est installé) est en position OFF ou si le fusible est rompu. Pour les produits alimentés par CC, les niveaux de tension ne sont généralement pas dangereux mais des risques de courant peuvent toujours exister.

Avant de travailler sur un équipement connecté aux lignes de tension ou de télécommunications, retirez vos bijoux ou tout autre objet métallique pouvant venir en contact avec les pièces sous tension.

Sauf s'il en est autrement indiqué, tous les produits sont destinés à être mis à la terre durant l'usage normal. La mise à la terre est fournie par la connexion de la fiche principale à une prise murale équipée d'une borne protectrice de mise à la terre. Si une cosse de mise à la terre est fournie avec le produit, elle devrait être connectée à tout moment à une mise à la terre de protection par un conducteur de diamètre 18 AWG ou plus. L'équipement monté en châssis ne devrait être monté que sur des châssis et dans des armoires mises à la terre.

Branchez toujours la mise à la terre en premier et débranchez-la en dernier. Ne branchez pas des câbles de télécommunications à un équipement qui n'est pas mis à la terre. Assurez-vous que tous les autres câbles sont débranchés avant de déconnecter la mise à la terre.

Connexion au courant du secteur

Assurez-vous que l'installation électrique est conforme à la réglementation locale.

Branchez toujours la fiche de secteur à une prise murale équipée d'une borne protectrice de mise à la terre.

La capacité maximale permissible en courant du circuit de distribution de la connexion alimentant le produit est de 16A. Le coupe-circuit dans l'installation du bâtiment devrait avoir une capacité élevée de rupture et devrait fonctionner sur courant de court-circuit dépassant 35A.

Branchez toujours le câble d'alimentation en premier à l'équipement puis à la prise murale. Si un commutateur est fourni avec l'équipement, fixez-le en position OFF. Si le câble d'alimentation ne peut pas être facilement débranché en cas d'urgence, assurez-vous qu'un coupe-circuit ou un disjoncteur d'urgence facilement accessible est installé dans l'installation du bâtiment.

Le disjoncteur devrait déconnecter simultanément les deux pôles si le système de distribution de courant est de type IT.

Connexion d'alimentation CC

Sauf s'il en est autrement spécifié dans le manuel, l'entrée CC de l'équipement est flottante par rapport à la mise à la terre. Tout pôle doit être mis à la terre en externe.

A cause de la capacité de courant des systèmes à alimentation CC, des précautions devraient être prises lors de la connexion de l'alimentation CC pour éviter des courts-circuits et des risques d'incendie.

Les unités CC devraient être installées dans une zone à accès restreint, une zone où l'accès n'est autorisé qu'au personnel qualifié de service et de maintenance.

Assurez-vous que l'alimentation CC est isolée de toute source de courant CA (secteur) et que l'installation est conforme à la réglementation locale.

La capacité maximale permissible en courant du circuit de distribution de la connexion alimentant le produit est de 16A. Le coupe-circuit dans l'installation du bâtiment devrait avoir une capacité élevée de rupture et devrait fonctionner sur courant de court-circuit dépassant 35A.

Avant la connexion des câbles d'alimentation en courant CC, assurez-vous que le circuit CC n'est pas sous tension. Localisez le coupe-circuit dans le tableau desservant l'équipement et fixez-le en position OFF. Lors de la connexion de câbles d'alimentation CC, connectez d'abord le conducteur de mise à la terre à la borne correspondante, puis le pôle positif et en dernier, le pôle négatif. Remettez le coupe-circuit en position ON.

Un disjoncteur facilement accessible, adapté et approuvé devrait être intégré à l'installation du bâtiment.

Le disjoncteur devrait déconnecter simultanément les deux pôles si l'alimentation en courant CC est flottante.

Declaration of Conformity

Manufacturer's Name:	RAD Data Communications Ltd.
Manufacturer's Address:	24 Raoul Wallenberg St., Tel Aviv 69719, Israel

declares that the product:

Product Name:	FCD-IP

conforms to the following standard(s) or other normative document(s):

EMC:	EN 55022:1998	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement.
	EN 50024: 1998	Information technology equipment – Immunity characteristics – Limits and methods of measurement.
Safety:	EN 60950: 2000	Safety of information technology equipment.

Supplementary Information:

The product herewith complies with the requirements of the EMC Directive 89/336/EEC, the Low Voltage Directive 73/23/EEC and the R&TTE Directive 1999/5/EC for wired equipment. The product was tested in a typical configuration.

Tel Aviv, 28 November 2004

Haim Karshen

VP Quality

European Contact: RAD Data Communications GmbH, Otto-Hahn-Str. 28-30, 85521 Ottobrunn-Riemerling, Germany

Quick Start Guide

Installation of FCD-IP should be performed only by an experienced technician. If you are familiar with FCD-IP, use this guide to prepare the units for operation.

1. Installing FCD-IP

Connecting the Interfaces

➤ To connect the interfaces:

1. Identify primary, secondary and user links installed in your FCD-IP.
2. Use the appropriate cable to connect all existing interfaces (primary and secondary WAN links, sublinks, LAN, data, voice and ISDN ports), according to your application.

Connecting the Power

➤ To connect the AC power:

1. Check that the ON/OFF switch on the FCD-IP rear panel is set to OFF.
2. Connect the power cable to the connector on the FCD-IP rear panel.
3. Connect the power cable to the mains outlet.

➤ To connect the DC power:

4. Check that the ON/OFF switch on the FCD-IP rear panel is set to OFF.
5. Refer to the DC power supply connection supplement.

2. Configuring FCD-IP

Configure FCD-IP to the desired operation mode via an ASCII terminal connected to the front panel CONTROL port.

➤ To start a terminal session:

1. Connect a terminal to the CONTROL connector of FCD-IP.
2. Turn on the control terminal PC and set its port parameters to 9,600 baud, 8 bits/character, 1 stop bit, no parity. Set the terminal emulator to ANSI VT100 emulation (for optimal view of system menus).
3. Power FCD-IP up and proceed with the management session.

4. Enter the password. (The default password for first-time connection is **1234**. You can change or remove it later.)

   The Main menu screen appears.

5. From the Main menu, select the Quick Setup menu or the Advanced Setup menu, and configure FCD-IP according to your applications requirements.

Contents

Chapter 1. Introduction

1.1 Overview....1-1
Product Options....1-1
Applications....1-2
Features....1-5
1.2 Physical Description....1-7
1.3 Functional Description....1-8
Main Link and Sublink Characteristics....1-8
Data Channel Interfaces....1-9
System Timing Considerations....1-9
Clock Recovery Behavior....1-9
Timeslot Handling....1-10
Ring Redundancy....1-10
Integrated Router....1-14
Bridging....1-14
Protocols....1-15
Management....1-15
1.4 Technical Specifications....1-16

Chapter 2. Installation and Setup

2.1 Introduction....2-1
2.2 Site Requirements and Prerequisites....2-1
2.3 Package Contents....2-2
2.4 Equipment Needed....2-2
2.5 Setting the Internal Jumpers and Switches....2-2
2.6 Mounting the Unit....2-2
2.7 Connecting the Interfaces....2-3
Connecting E1/T1 Interface....2-3
Connecting IO Data Channel....2-3
Connecting the Control Port....2-4
2.8 Connecting the Power....2-4
Fuses....2-4
Connecting AC Power....2-5
Connecting DC Power....2-5

Chapter 3. Operation

3.1 Turning On the Unit....3-1
3.2 Indicators....3-1
3.3 Configuration and Management Alternatives....3-4
Configuring FCD-IP via Terminal....3-4
Configuring FCD-IP via Telnet....3-6
Connecting via SNMP Management....3-6
3.4 Turning FCD-IP Off....3-6

Chapter 4. Configuration

4.1 Overview....4-1
4.2 Main Menu....4-5

4.3 Quick Setup Menu 4-6
Quick Setup Parameters 4-6
Quick Setup Menu Examples 4-7
Configuring the WAN Interface 4-10
Configuring the LAN Interface 4-12
Configuring the ISDN Interface 4-14
Configuring the Frame Relay Connections 4-14
Selecting the DLCI Number 4-14
Configuring Asynchronous V.24 Interface 4-15
Configuring Security Options 4-15
4.4 Configuring Security 4-15
Restricting Access to FCD-IP 4-16
Configuring Firewall 4-18
Configuring IP Address Translation (NAT) 4-21
4.5 Configuring Device Control 4-23
Setup Menu 4-23
Configuring Device Control Options 4-24
4.6 Viewing FCD-IP Configuration and Status 4-28
Displaying FCD-IP Configuration 4-29
Displaying Interface Connections 4-30
Viewing Routing Tables 4-30

Chapter 5. Performing Advanced Setup

5.1 Defining Host Parameters 5-2
Entering Device ID 5-3
Defining IP Host Parameters 5-4
Defining SNMP Managers 5-6
Configuring TFTP Parameters 5-7
Configuring RADIUS (Authentication and Billing) 5-8
5.2 Configuring Routing/Bridging 5-9
Selecting Interface Routing/Bridging Mode 5-11
Defining Static Stations and Nets 5-14
Setting IP Routing 5-15
Configuring IPX Routing 5-24
Configuring Station Ageing 5-26
Configuring NTP Settings 5-26
5.3 Configuring the Interfaces 5-27
5.4 Configuring Link Parameters 5-29
5.5 Configuring LAN Parameters 5-31
5.6 Configuring E1/T1 Interfaces 5-31
T1 Features 5-32
E1 Features 5-33
5.7 Configuring the T1 Interface 5-34
Configuring T1 Link Parameters 5-36
Configuring Additional Card Parameters 5-38
Advanced Setup Menu 5-45
5.8 Configuring E1 Interface 5-48
Defining E1 Link Parameters 5-51
Defining Additional Card Parameters 5-52
Advanced Setup Menu 5-59
Configuring the ISDN Interface 5-61
Configuring the Frame Relay Interface 5-63

5.9 Configuring Access Control (Security) 5-68
Defining External Access Security (only Relevant to Link with PPP Protocol) 5-69
Defining Device Security Identity (PPP only) 5-70
Configuring Security Host/Guest (PPP only) 5-71
Defining Login Script 5-71
5.10 Configuring WAN Economy 5-73
Defining Filters 5-75
Configuring Connection on Demand 5-82
Defining Spoofing 5-86
5.11 Resetting FCD-IP to the Defaults 5-88

Chapter 6. Configuring FCD-IP for a Typical Application

6.1 Overview 6-1
Application 6-1
Guidelines for Configuring FCD-IP 6-1
6.2 Configuring the WAN Interface 6-2
6.3 Configuring E1 Parameters 6-3
6.4 Configuring LAN Host Parameters 6-4

Chapter 7. Troubleshooting and Diagnostics

7.1 Monitoring Performance 7-1
Displaying Statistics 7-1
Displaying E1/T1 Diagnostics 7-2
Displaying E1/T1 Alarms Log File 7-4
7.2 Alarm Collection and Reporting 7-5
Alarm Buffer 7-5
Alarm Display 7-5
Setting the T1 Alarm Filter 7-6
Setting the E1 Alarm Filter 7-6
Alarm Messages 7-7
7.3 General Troubleshooting 7-10
7.4 Pinging Remote Hosts 7-10
7.5 E1/T1 and Voice Troubleshooting 7-12
7.6 Router Connections Troubleshooting 7-12
IP connection to LAN is Down 7-12
IP Connection to WAN is Down 7-12
7.7 Performing T1 Diagnostics 7-14
Running Loopbacks 7-14
Using Voice Diagnostic Tools 7-17
7.8 Performing E1 Diagnostics 7-17
Running Loopbacks 7-18
Using Voice Diagnostic Tools 7-19
7.9 Frequently Asked Questions 7-20
7.10 Technical Support 7-21

Appendix A. Interface Specifications and Pinouts

Appendix B. Boot Manager

Appendix C. SNMP Management

Appendix D. Glossary

Chapter 1
Introduction

1.1 Overview

FCD-IP is an E1/T1 or fractional E1/T1 Integrated Access Device (IAD), which enables service providers to bundle voice and Internet access services over a single E1 or T1 access line. FCD-IP connects an Ethernet LAN to the Internet or Intranet through the integrated IP/IPX router or bridge. The connection is made via E1/T1 links, operating at data rates of up to 2.048 Mbps for E1, 1.544 Mbps for T1 with optional backup for data using E1/T1, ISDN or PSTN networks. WAN data protocols supported are Frame Relay, PPP and MLPPP. FCD-IP also supports two Ethernet LAN connections, or a four port switch.

FCD-IP provides transparent data and voice capabilities over the E1 or T1 access line, such as a synchronous data channel that supports user-selectable transmission rates, digital voice over sub E1 or T1 link that supports PBX and analog FXS, FXO and E&M voice ports.

Product Options

There are several versions of FCD-IP, and each version has its own specific options.

The following options are available for ordering as part of FCD-IP:

- Main WAN Interface
  - E1/T1 Interface (one or two links)
  - Sub-E1/T1, analog voice, and ISDN backup interface options:
  - S: supports sub-E1/T1 (up to three interfaces)
  - FXS: supports 4 FXS voice channels
  - FXO: supports 4 FXO voice channels
  - E&M: supports 4 E&M voice channels
  - IBE: supports ISDN "S" interface
  - IBU: supports ISDN "U" interface.
- WAN interface options (up to two data ports):
  - T1 or fractional T1 CSU/DSU operating at up to 1.544 Mbps
  - E1 or fractional E1, with or without LTU, operating at up to 2.048 Mbps
  - E1/T1 over fiber optic links with interfaces:

        - 850 nm LED for use over multimode fiber at distances up to 5 km (3 miles)
        - 1310 nm LED for use over single mode fiber at distances up to 47 km (29 miles)
        - 1310 nm laser diode for use over single mode fiber at distances up to 62 km (38 miles)
        - 1550 nm laser diode for use over single mode fiber for extended range up to 100 km (62 miles).
    - Data port interfaces:
        - V.35 with 34-pin female via adapter cable
        - V.24/RS-232 or RS-530 with 25 pin D-type, female
        - X.21 with 15-pin D-type, female via adapter cable
        - V.36/RS-422 with 37-pin D-type, female via adapter cable.
- LAN interface options:
    - One 10/100BaseT port with RJ-45 connector (UTP)
    - Two 10BaseT ports with RJ-45 connector (UTP).
    - 4-port 10/100BaseT switch.

Note *Only two links are supported, which limits the configuration options. For example, the second WAN option is not available when configuring E1/T1 with an ISDN backup.*
The dual LAN configuration is not available when configuring E1/T1 with an ISDN backup.

Applications

FCD-IP is the solution for several different applications. Order your unit according to your specific application requirements. FCD-IP can be used as a router for the office LAN to access the Internet/intranet and at the same time control access from the local PBX to the E1/T1 line. FCD-IP can also have up to four telephones connected directly to the unit for those applications where a PBX is not present.

The following is a list of application options for FCD-IP:

FCD-IP with PBX and LAN - In the application shown in *Figure 1-1*, FCD-IP supports a single LAN connection to the Internet/Intranet and voice connectivity to the PSTN.

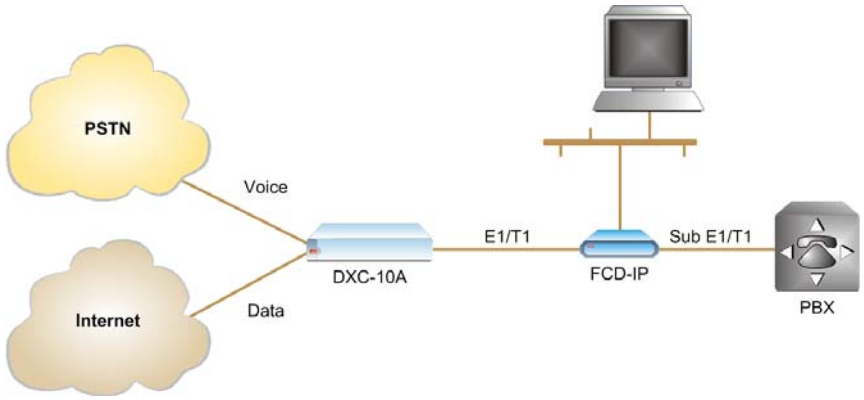


Figure 1-1. FCD-IP with PBX and LAN

FCD-IP with four Telephones and LAN – In the application shown in *Figure 1-2*, **FCD-IP** supports four individual telephones connected to the carrier, and a LAN connection to the Internet/Intranet.

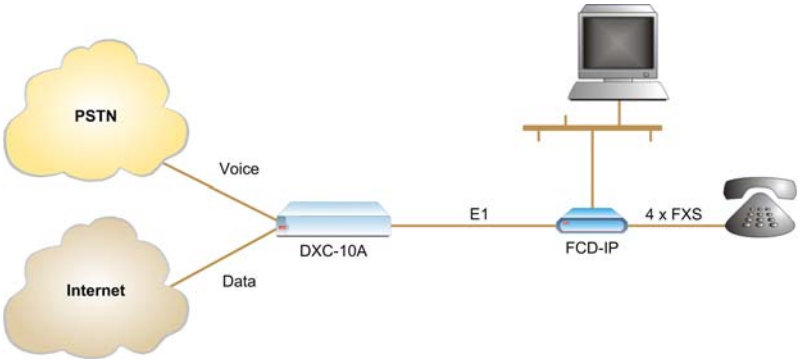


Figure 1-2. FCD-IP with Four Telephones and LAN over E1

FCD-IP with Chain Configuration - *Figure 1-3* shows the FCD-IP in a chain configuration. When this mode is configured, the FCD-IP has two links, which means traffic from any data timeslot of each link is passed to the integrated router/bridge. This allows you to concatenate any number of FCD-IP devices (the last one possibly working in Normal mode since it has only one E1/T1 uplink), using only one E1/T1 line between each pair, and still be able to share data timeslots of any device with any other device in the chain.

Note

In order to configure Chain mode, the device must have at least two E1/T1 interfaces (labeled Main and Sub1 or Sub1/Link2, on the rear panel), and Link 2 resources cannot be used by other link (such as ISDN or DTE card) or by a second LAN.

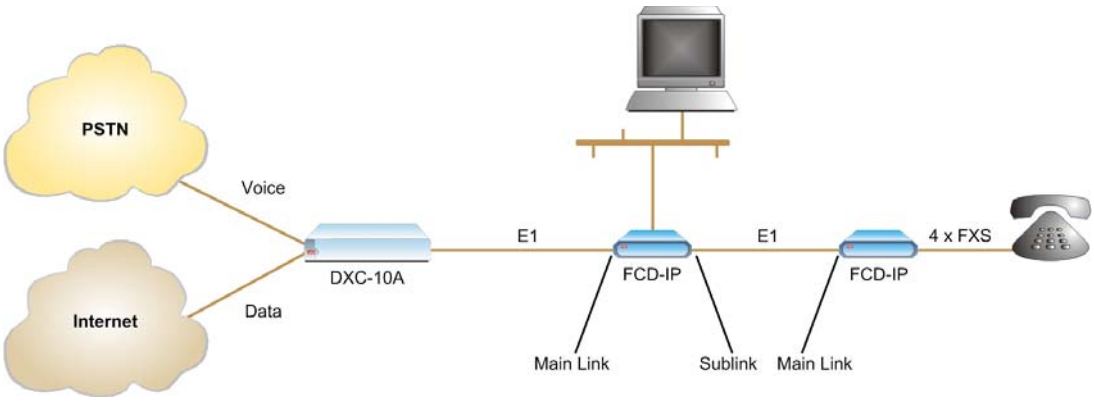


Figure 1-3. FCD-IP with One Telephone and LAN Using a Chain Configuration

FCD-IP with RAD Ring Configuration - *Figure 1-4* shows the RAD Ring solution. This unique application provides virtually immediate recovery of all services in case of failure of any single E1 interface.

Two failures at the same time mean that some of the devices are disconnected from the ring. However, services between devices that are still connected will continue to operate.

In case of PPP failure while E1 lines are still up, services will reestablish, but in some cases it might take a few seconds for the devices to realize that PPP is down.

The user may select one of two mechanisms (Wait To Restore and Recovery Timeout) to determine how much time the devices should wait before reusing an E1 line that failed. This feature prevents the use of unstable E1 lines.

When connecting devices in a ring, the main link must be connected to the SUB 1 of its peer. An improper connection will cause an alarm, helping the user to properly connect the devices.

Ring Plus Shared LAN configuration is an enhancement to Ring configuration. When configured, the device has two E1 links, which means that each data timeslot, from either link, is passed to the integrated router/bridge. This enables you to share data timeslots throughout the entire ring, each device taking the data relevant to it, and passing the rest forward.

In Ring configuration, data timeslots can be configured only between two of the Ring devices and all the others must pass through transparently. On the other hand, in Ring Plus Shared LAN mode, the same data timeslots can be configured on two or more Ring devices, all sharing the same bandwidth, which saves on expensive E1 lines. This mode allows each machine on any LAN connected to a Ring device, to send data to any other machine; hence the name Shared LAN.

Note

- *In order to configure Ring Plus Shared LAN mode, the device must contain at least two E1 interfaces (labeled Main and Sub1/Link2 on the rear panel) and Link 2 resources cannot be used by another link (such as ISDN or DTE card) or by a second LAN.*
- *The Ring can consist of FCD-IP devices and any other RAD device that supports Ring configuration (such as Megaplex).*
- *In this version, Ring and Ring Plus Shared LAN can be configured on E1 only.*

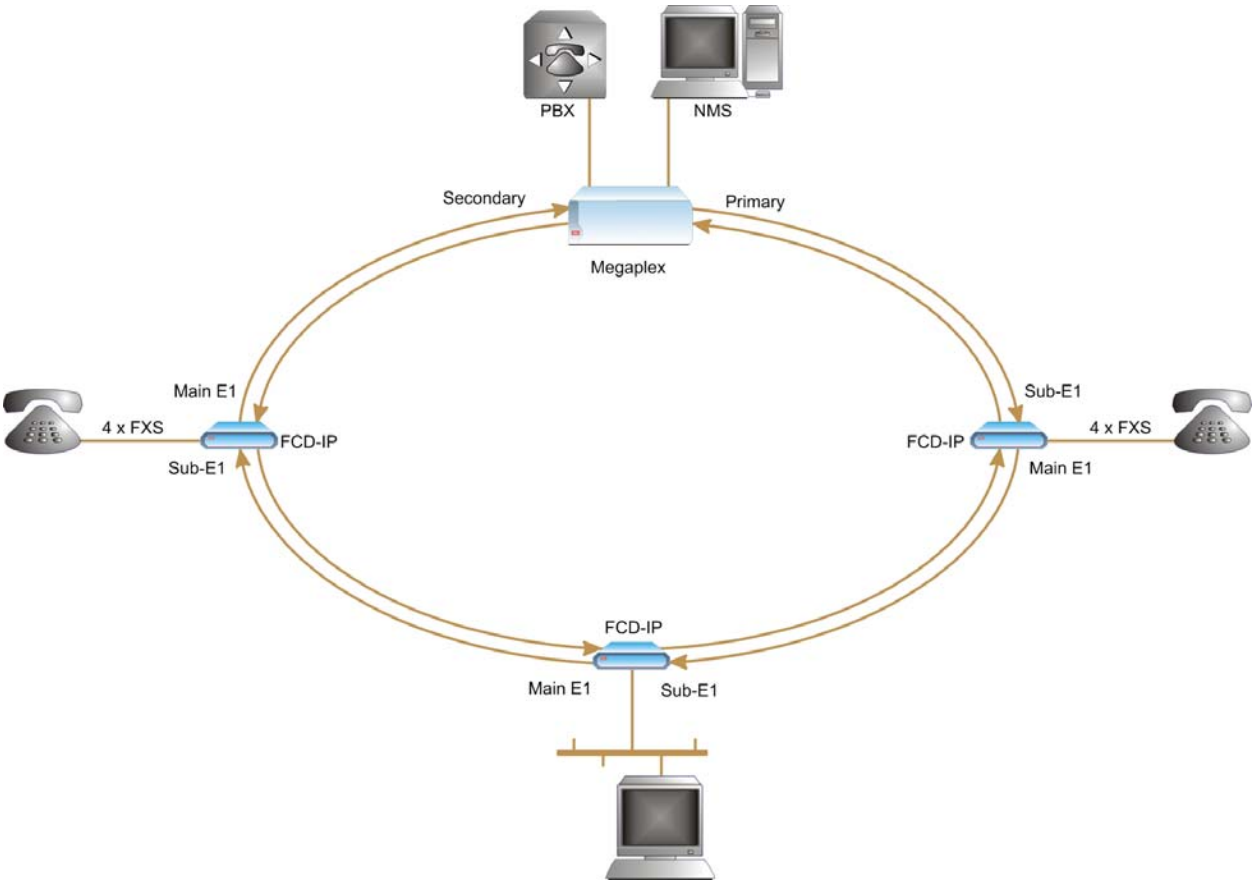


Figure 1-4. FCD-IP with Ring or Ring Plus Shared LAN Configuration

Features

E1/T1 Main Link

- E1/T1 Integrated Access Device (IAD) for Internet/intranet and voice connectivity
- Integral E1 with or without LTU or Integral T1 CSU/DSU
- Up to three sub-E1/T1 drop and insert port for PABX connectivity; one of them can serve as second link
- Fail-safe bypass for the sub-E1/T1 link (not available for the fiber optic main link)
- Optional fiber optic uplink
- ISDN uplink.

Integrated Router

- IP and IPX routing and standard bridging
- Supports Frame Relay, PPP and MLPPP

- One or two Ethernet ports, one Fast Ethernet port, or a four port Fast Ethernet switch
- Optional dial-up or integrated ISDN backup
- PAP/CHAP authentication
- Solid Firewall protection
- NAT and Single IP address translation
- DHCP server and relay
- OSPF Protocol
- RIP1 and RIP2 Protocols
- NTP support (for time and date learning from the network)
- Gratuitous ARP
- Quick setup and configuration
- Dual in-band and out-of-band remote management
- SNMP and Telnet support
- Dual management authorization levels (carrier/user)
- Flash memory for software and parameter file downloading
- Remote software and parameter file download.

Ethernet/Fast Ethernet Switch

- Built-in 4-port switch with 1Mb buffer with Auto-polarity and auto-negotiation.

Data

- Optional second data port (transparent N × 64/56 kbps or serial router port).

Voice

- Supports four analog voice channels
- PCM encoded, A-Law or μ-Law
- Optional interfaces: 2-wire FXS, 2-wire FXO, or 4-wire or 2-wire E&M.

1.2 Physical Description

FCD-IP units are delivered completely assembled. The units are designed for desktop installation, or to be mounted in a 19-inch rack. Installation procedures for FCD-IP models and respective versions are provided in *Chapter 2*.
Figure 1-5 shows a 3-D diagram of FCD-IP.

Figure 1-5. FCD-IP General View

Controls and indicators of the various versions of FCD-IP and their functions are described in *Chapter 3*. The LED indicators on the front panel indicate the operating status of FCD-IP. Various indicators display status of user's data port, status of data activity in user's data connector, and alert conditions. For a description of the front panel, refer to *Chapter 3*.

The power and interface connectors are located on the rear panel of FCD-IP. For a description of the rear panel, refer to *Chapter 2*.

The internal jumpers of FCD-IP are set according to options ordered. There is no need to change any of the jumpers.

1.3 Functional Description

This section describes the main and sublink characteristics, the data and voice channel interfaces, timing considerations, time slot handling, integrated IP router and management of FCD-IP. *Figure 1-6* shows a functional block diagram for FCD-IP.

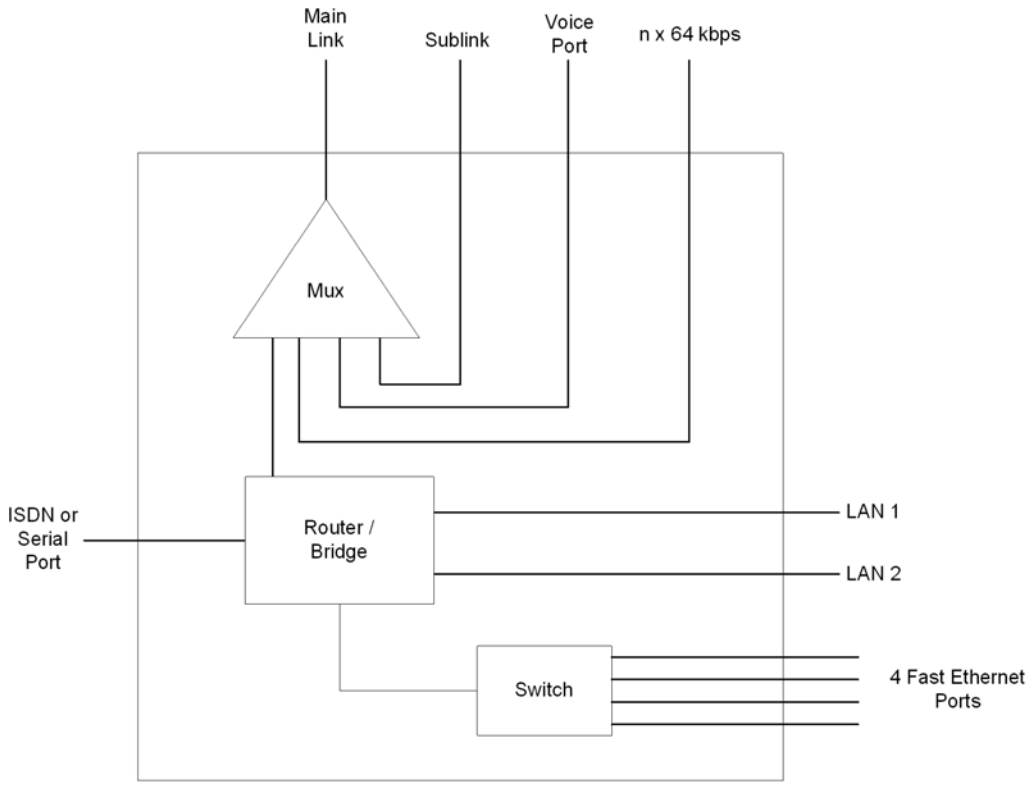


Figure 1-6. FCD-IP Functional Block Diagram

FCD-IP can be ordered in several configuration options. A main link is always E1/T1, and there is always at least one LAN link. The other interfaces may be a sub E1/T1, analog voice, ISDN backup or n x 64 data port.

Main Link and Sublink Characteristics

FCD-IP can contain up to four E1/T1 interfaces; one or two of them can be links (that is, incoming traffic from these links is passed though the integrated router/bridge). While link 1 always exists, you can configure link 2 when the following conditions are met:

- The device has at least two E1/T1 interfaces on the rear panel, labeled Main and Sub1, or Main and Sub1/Link2
- Link 2 is not occupied by other hardware (for example, ISDN or DTE card)
- LAN 2 does not exist.

The FCD-IP E1 main and sublink meet the requirements of ITU-T Rec. G.703, G.704, G.706, G.732, and G.823, and support 256N and 256S multiframes (2 or 16 frames per multiframe, respectively), in accordance with ITU-T Rec. G.704. For FCD-IP T1 versions the main and sublink comply to AT&T TR62411 and ANSI T1.403 standards, and support D4 and ESF framing.

The framed mode and use of the CRC-4 function are user-selectable.

The main and sublink line interfaces:

For E1:

- 120Ω balanced line interface, terminated in an RJ-48C eight-pin (ISO 10173) connector
- Using an adapter cable, the E1 can be converted to a 75Ω unbalanced interface, terminated in two BNC coaxial connectors.

For T1:

- 100Ω balanced interface.

You can select the E1 interface to activate the LTU option. With the T1 version, you can choose to activate CSU or DSU.

When a power failure occurs, the failsafe bypass of the sub E1/T1 link ensures the continuity of voice services between the main and the sublink.

Note *The fail-safe bypass of the E1/T1 sub-link is not available for the FCD-IP units equipped with fiber optic E1/T1 interface.*

Data Channel Interfaces

The data channel can be operated in several ways:

- As n × 64 kbps or n × 56 kbps data port (DCE only)
- As serial router port that supports IP/IPX routing and bridge over PPP or Frame Relay (DTE only).

System Timing Considerations

Internally, FCD-IP uses one system timing source (clock). This system clock determines the transmit timing of all the E1 links and data ports. The clock source options are as follows:

- Main link (each of them)
- Sublink (each of them)
- Internal.

Clock Recovery Behavior

When the clock source is configured as Internal, the clock source remains the same regardless of the state of the interfaces. However, when one or more interface is configured as the clock source, FCD-IP takes the following steps, upon failure, to provide the device with an alternative clock source:

- Normal and Chain application modes:
  - FCD-IP automatically reverts to the internal clock. It switches back to deriving its clock from that interface as soon as the interface is up again.
- Ring and Ring + Shared LAN application modes:
  - Upon failure of a non-Ring interface (that is, Sub 3 or Sub 4), FCD-IP behaves the same as in Normal mode (see above).
  - Upon failure of a Ring interface (that is, Main or Sub1), FCD-IP takes the clock source from the other Ring interface. If both are down, it switches to the internal clock. When the interface is up again, it provides the clock as originally configured.

Timeslot Handling

FCD-IP allows the user to configure each of the individual time slots freely according to the following options:

- Data Link 1 – in Normal and Ring modes, for data from router/bridge
- Data Link 1+2 – in Chain and Ring + Shared LAN modes, for data from router/bridge (in this case, the device has two E1/T1 links)
- SUB Voice – for voice from sublink
- SUB Data – for data from sublink
- Voice (1, 2, 3, 4) – for analog voice port 1, 2, 3, 4.

For more information on configuring timeslots, refer to *Chapter 4*.

Ring Redundancy

Ring Redundancy is a proprietary RAD topology that provides higher availability for critical applications. This topology is based on the use of two transmission paths, each requiring a single twisted pair. Therefore, ring redundancy can use the same cabling infrastructure as a regular point-to-point link. The two pairs form a closed dual-ring topology, similar to the topology implemented in SDH transmission networks: one path propagates data "clockwise" and the other "counterclockwise". In this manner, each FCD-IP can receive data through two different paths, and selects only the signal received through one of the paths for processing.

You can implement this topology using the FCD-IP's Main and Sub1 E1 ports. The following figure shows a typical application using the Ring Redundancy topology.

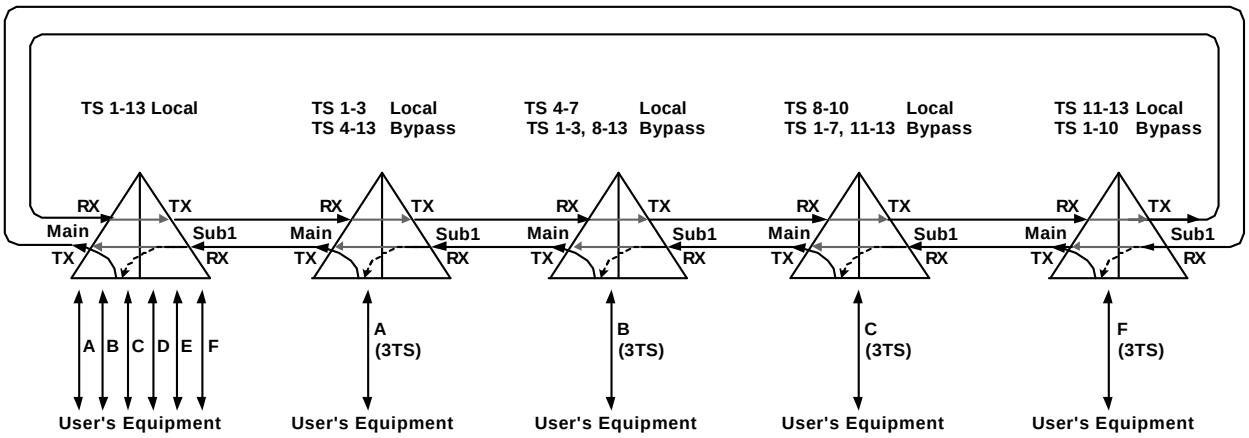


Figure 1-7. E1 Ring Redundancy Topology – Signal Flow during Normal Operation

In each FCD-IP unit, the Main and Sub1 ports are connected to the ring. Under normal conditions, each FCD-IP transmits through the Main link and receives through the Sub1 link. Therefore, in *Figure 1-7* the primary ring propagates data clockwise. The payload is handled as follows:

- Primary ring – at each unit, timeslots used by the local unit are dropped from the receive side of the Sub1 port, and added to the transmit side of the Main port. Timeslots used by the other FCD-IP units are bypassed directly between these two ports.
- Secondary ring – all the timeslots received by the Main port are bypassed to the transmit side of the Sub1 port.

If one of the segments in the ring fails (see *Figure 1-8*), the two FCD-IPs detect the loss of signal and change the signal routing within the corresponding units so that each unit now receives and transmits only through the synchronized port. Timeslots previously bypassed between the ports are now transferred between the receive and transmit sides of the active port (by creating a special internal local loopback), thereby preserving transmission path continuity.

The ring can sense a PPP failure between two devices even if both E1 lines remain up, but it may take a few seconds to do so. Since both E1 lines are still up, the clocking system is not affected by such a failure, unlike the case of a nonfunctional E1 line.

Note that all other FCD-IP units do not need to change their operating configuration; only the units that are connected to the failed segment must take action in response to the failure.

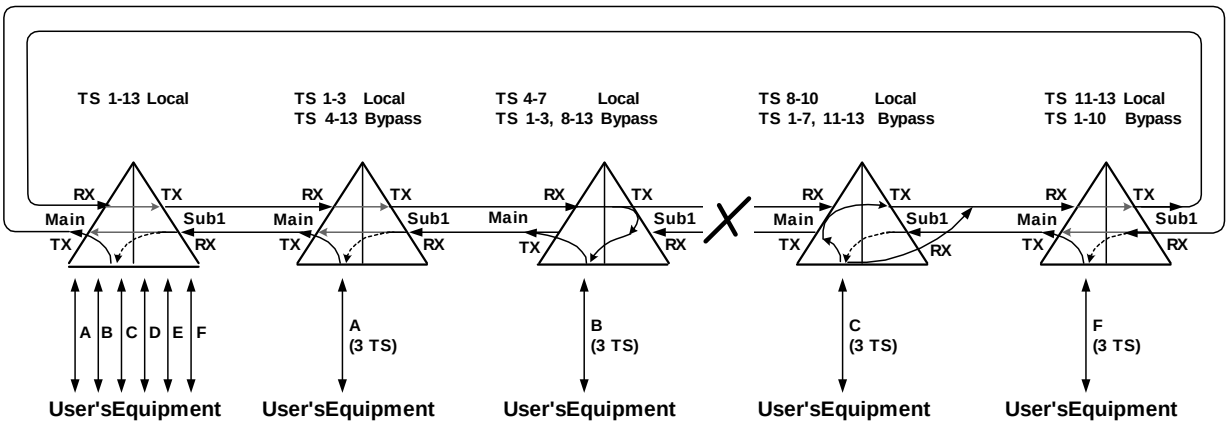


Figure 1-8. E1 Ring Redundancy Topology – Signal Flow after Segment Failure

Double Loop Detection

During a single failure in a ring system, all services continue as usual. In case of dual failures, the ring is split into two parts. Services terminating in devices that reside in the same segment continue, while services between devices on different segments stops until at least one of the failed E1 lines is reestablished.

Clock Distribution

When using Ring Redundancy, it is necessary to ensure that the reference timing is distributed in a controlled way to all the units in the network. This requires the selection of one device in the ring as the clock source. That is, its clock should be configured as 'Internal' (or 'Sub2' or 'Sub3' when it takes it's clock from one of these interfaces). All remaining devices in the ring must take their clock from either the Main or Sub1 link.

You must ensure that the following configuration does *not* occur: one device's clock source is configured as 'Main' while the one connected to its Main link is configured as 'Sub 1' (or vice versa).

It is recommended that half of the devices in the ring (those closer to the Main link of the device which is used as the clock source), be configured to take their clock from 'Link 1' (i.e. Main), while the other half be configured to take their clock from 'Sub1'.

The device that is configured to supply clock to the ring ('Internal', 'Sub2', or 'Sub3') never changes its clock source. All other devices change automatically, from Main to Sub1 or vice versa, when the link from which they receive clock fails. When the link recovers, the clock source returns to normal.

A propriety protocol is used by each device, when one of its links fails, to notify peer devices. Peer devices also need to change their clock source, in case they were receiving their clock from the same side on which the link failed. This protocol runs over the inband management links.

In a situation where both of a device's links fail: if the device is configured to take its clock from ether Main or Sub1, it switches to Internal clock until one of its links recovers.

Figure 1-9 and *Figure 1-10* show the timing reference flow before and after recovery.

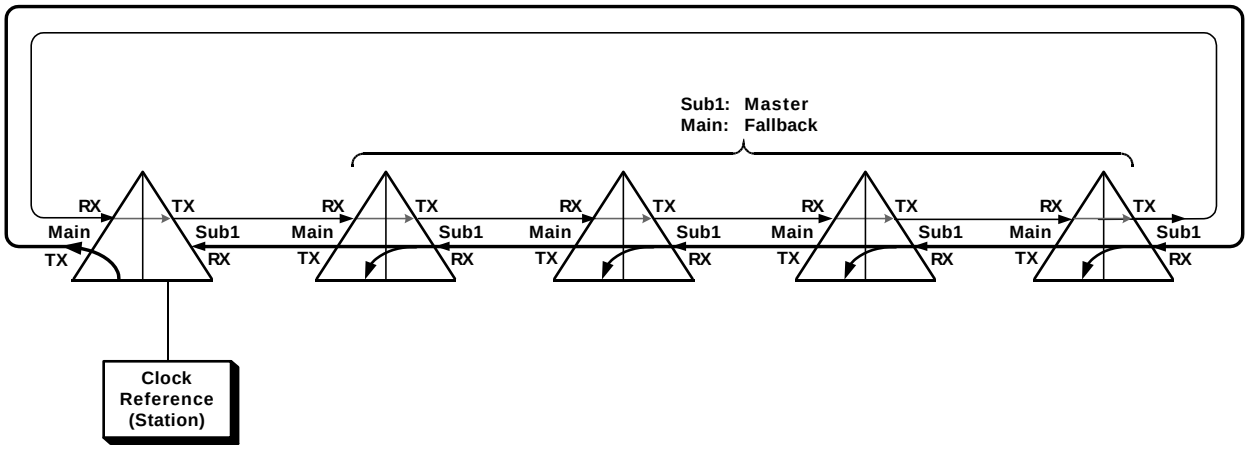


Figure 1-9. E1 Ring Redundancy Topology – Normal Timing Reference Flow

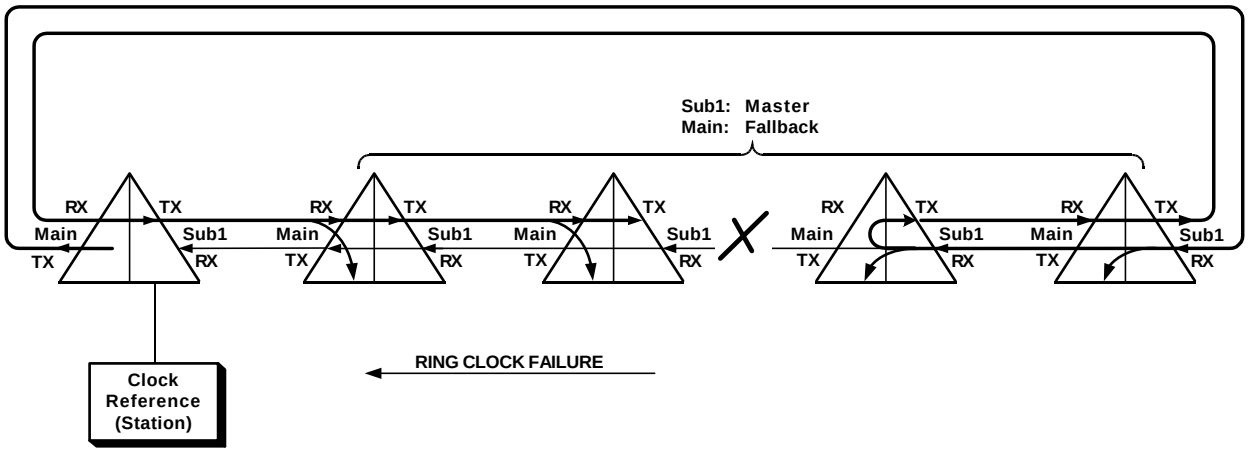


Figure 1-10. E1 Ring Redundancy Topology – Timing Reference Flow after Segment Failure

To prevent unstable lines from constantly changing clock sources and opening/closing loops, the user may choose between two mechanisms:

- *Recovery Timeout* – If a ring interface fails, it is considered 'down' for the period of the recovery timeout, even if it recovers before the timeout is reached. After the timeout expires, the actual state of the interface is tested. If the link is up, the appropriate actions are taken.
- *Wait To Restore* –If a ring interface fails, it is considered 'down' until it recovers during the WTR period and no alarm has occurred. Each alarm zeros the WTR timer.

The default value for the recovery timeout is 12 seconds, and for the WTR is 300 seconds.

Note

A ring may comprise up to 66 devices.

All the devices in a ring should use the same mechanism and the same timeout values.

For proper operation of the ring, enable Inband Management on the Main link and Sub1 link (in the E1 Advanced Setup menu).

In Megaplex terminology, the main link of FCD-IP is the 'primary' port. When connecting an FCD-IP to a Megaplex in a Ring topology, it is important that the FCD-IP's main link be connected to the Megaplex's secondary port, and the FCD-IP's Sub1 link be connected to the Megaplex's primary port.

Alarms are generated to alert the user when the ring is misconnected (main link connected to main link or Sub1 to Sub1).

Integrated Router

IP Router

FCD-IP as an IP router supports:

- Static IP net configuration
- Dynamic IP net learning using OSPF, RIP-1 and RIP-2 protocols
- CIDR topologies
- Multiple IP nets on the LAN
- Numbered and unnumbered interfaces
- IP fragmentation
- Gratuitous ARP

IPX Router

FCD-IP also supports standard IPX routing that includes support for RIP and SAP.

Bridging

FCD-IP supports bridging. The bridge is used to interconnect a number of LANs by accessing layer 2 (MAC layer). FCD-IP automatically extends the scope of any interface, allowing the interface to interconnect several networks, providing that all supported interfaces are set to bridge mode.

FCD-IP interconnects:

- Any LAN to link
- Two LANs of the same Bridge
- Two LANs and link.

FCD-IP interconnects all of its interfaces to one extended LAN.

FCD-IP supports standard bridging, as specified in IEEE 802.1D, and can operate opposite any other third party bridge. Spanning Tree Algorithm is not supported.

Bridging works over PPP, Frame Relay RFC-1490 and also a 'Native' protocol. MAC frames pass in an HDLC format.

Protocols

FCD-IP supports:

- PPP (Point to Point Protocol) – this protocol supports a variety of links and connection options
- Frame Relay – a network interface, which provides high-speed frame or packet transmission with minimum delay and maximum bandwidth utilization.

Management

FCD-IP features a variety of inband and out-of-band management options. These options include dedicated time slot, dedicated DLCI, and dial-in connectivity.

You can manage the following capabilities:

- FCD-IP configuration
- Viewing FCD-IP status
- Testing FCD-IP
- Viewing alarm status and history.

The management functions are performed via:

- SNMP management – enables management using the RADview or any other standard SNMP-based management systems.
- Telnet – enables a remote IP host to control the operation of FCD-IP using functions identical to those provided by a supervision terminal.
- Supervision terminal – an ASCII terminal connected to the RS-232 control port of FCD-IP (or a PC running a terminal emulation program) can be used as a supervision terminal.

Undesired access to FCD-IP via Telnet or SNMP can be blocked by the firewall, or password protected. The dual-level management authentication allows access to router configuration parameters while restricting the access to network configuration parameters.

Software download is available via the control port using XMODEM and via LAN/WAN using TFTP. Parameter file download and upload is available via LAN or WAN using TFTP.

FCD-IP has an alarm history memory that holds the up to 100 alarms.

Management Using Dedicated Timeslot (DTS)

FCD-IP features out-of-band management through a dedicated timeslot.

The DTS is a management channel that connects directly to the FCD-IP host using a separate IP interface, i.e. address, and operates as an additional WAN interface connected to the management IP network.

This management channel is totally separated from the IP traffic that the integrated router forwards, so there is no way to expose the manager IP network to unauthorized IP users.

The DTS channel should be synchronized with other equipment such as a cross-connect unit or router. This can be done with standard WAN protocols such as Frame Relay and PPP.

In Chain or Ring + Shared LAN modes, when two links exist, in-band dedicated timeslot management is configurable independently on either link.

Management traffic has priority over any other incoming and outgoing traffic, in order to enable smooth management even under heavy traffic conditions. Yet there is no risk of the device being bombarded by too much management traffic, exploiting the priority of management traffic, to prevent any other traffic from being handled; dedicated timeslot bandwidth is limited by its nature to 64 kbps x 2 (in a worse case scenario, if it is enabled on both E1/T1 links). This prevents the device from being saturated with management traffic.

1.4 Technical Specifications

E1 Link Interface

Framing Options	256N (no MF, CCS) 256N (no MF, CCS) with CRC-4 256S (TS16 MF, CAS) 256S (TS16 MF, CAS) with CRC-4
Bit Rate	2.048 Mbps
Line Code	AMI
Zero Suppression	HDB3
Line Impedance	Balanced interface: 120Ω Unbalanced interface: 75Ω
Signal Levels	Receive level: • FCD-IP with LTU: 0 to –30 dB • FCD-IP without LTU: 0 to –12 dB Transmit level: • Balanced interface: ±3V ±10% • Unbalanced interface: ±2.37V ±10%
Jitter Performance	As per ITU-T Rec. G.823

	Connectors	Balanced interface: RJ-45 8-pin Unbalanced interface: Two BNC coaxial (via adapter cable)
	Compliance	ITU G.703, G.704, G.706, G.732
	Diagnostics	User activated local and remote loopbacks
T1 Link Interface	*Framing Options*	D4 ESF
	Bit Rate	1.544 Mbps
	Line Code	AMI
	Zero Suppression	Transparent B7ZS B8ZS
	Impedance	Balanced: 100Ω
	Signal Level	Receive level: • FCD-IP with CSU: 0 to –36 dB • FCD-IP without CSU: 0 to –10 dB Transmit level: • FCD-IP with CSU: 0, -7.5, -15, -22.5 dB • FCD-IP without CSU: soft adjustable at 0 to 655 ft.
	Jitter Performance	As per AT&T TR-62411
	Connectors	RJ-45 8-pin, balanced
	Compliance	AT&T TR62411, ANSI T1.403
	Diagnostics	User available local and remote loopbacks Network activated loops and FDL loops (RLB, LLB)
Analog Voice	*Number of Voice Channels*	4 per card
	Modulation Method	PCM (per ITU-T G.711 and AT&T PUB-43801) μ-Law or A-Law

Interfaces	**E&M**: 2-wire or 4-wire, supporting different types of E&M signaling: RS-464 Types I, II, III, and V, and BT SSDC5, configured by software **FXS**: Loop start, WINK start (reverse polarity) for direct connection to a 2-wire telephone **FXO**: Loop start, WINK start (reverse polarity) for connection to a 2-wire telephone exchange subscriber line Nominal level: 0 dBm Nominal impedance: 600Ω Return loss (ERL): Better than 18 dB Frequency response: (Ref: 1020 Hz) • ±0.5 dB, 300 to 3000 Hz • ±1.1 dB, 250 to 3400 Hz Signal to total distortion, G.712, G.713 method 2: • 0 to –30 dBm0, better than 33 dB • +3 to –45 dBm0, better than 22 dB Idle channel noise: Better than –70 dBm0 (+20 dBrnc) Transformer isolation: 1500 VRMS
Diagnostics	Remote analog loopback towards the remote side, activated from local side 1kHz tone injection towards analog side Activity indicators
Connectors	• E&M: RJ-45, 8-pin • FXS, FXO: RJ-11, 6-pin

ISDN	*Interfaces*	ISDN BRI, "S" and "U"
	Compliance	ETS 300012 I.430 NT1 5ESS DMS-100 NI1
WAN Protocols	*Types*	Frame Relay – RFC 1490 PPP and MLPPP
Routing	*Types*	STATIC RIP-1 RIP-2 OSPF
LAN Interface	*Number of Ports*	1, 2 or 4
	Compliance	IEEE 802.3
	Types	• Single 10/100BaseT (RJ-45) port • Dual 10BaseT (RJ-45) • 4-port 10/100BaseT (RJ-45) switch
Data Port Interfaces	*Interfaces/Connectors*	V.35 with 34-pin female via adapter cable V.24/RS-232 or RS-530 with 25-pin D-type female X.21 with 15-pin D-type female via adapter cable V.36/RS-422 with 37-pin D-type female via adapter cable
Fiber Optic Interfaces	*Interface Options*	850 nm LED 1310 nm LED 1310 nm laser diode 1550 nm laser diode
	Connectors	ST FC/PC SC
	Compliance	ITU G.921, G.956

Indicators	PWR (green)	Power status
	READY (green)	Self-test result
	LAN 1 DATA (yellow)	LAN 1 data transmit/receive status
	LAN 2 DATA (yellow)	LAN 2 data transmit/receive status
	LINK 1 DATA (yellow)	Link 1 data transmit/receive status
	LINK 2 DATA (yellow)	Link 2 data transmit/receive status
	LAN 1 ERR (red)	LAN 1 error status
	LAN 2 ERR (red)	LAN 2 error status
	LINK 1 ERR (red)	Link 1 error status
	LINK 2 ERR (red)	Link 2 error status
	LINK1 RED ALARM (red)	Link 1 red alarm status (T1 only)
	SUB RED ALARM (red)	Sub-T1 1 red alarm status (T1 only)
	LINK1 YELLOW ALARM (yellow)	Link 1 yellow alarm status (T1 only)
	SUB YELLOW ALARM (yellow)	Sub-T1 1 yellow alarm status (T1 only)
	LINK1 LOC SYNC LOSS (red)	Link 1 local sync loss status (E1 only)
	SUB LOC SYNC LOSS (red)	Sub-E1 local sync loss status (E1 only)
	LINK1 REM SYNC LOSS (red)	Link 1 remote sync loss status (E1 only)
	SUB REM SYNC LOSS (red)	Sub-E1 remote sync loss status (E1 only)
	LINK (green)	LAN link status (rear panel)
	100M	LAN speed (rear panel)
Physical	*Height*	44 mm (1.7 in) (1U)
	Width	216 mm (8.5 in)
	Depth	240 mm (9.4 in)
	Weight	1.1 kg (2.5 lb)

Power	*Supply Voltage*	100–240 VAC, 50 to 60 Hz, 25 VA max 24/48 VDC
	Power Consumption	12W max
Environment	*Temperature*	0° to 50°C (32° to 122°F)
	Humidity	Up to 90%, non-condensing

Chapter 2

Installation and Setup

2.1 Introduction

This chapter provides instructions for mechanical and electrical installation of the FCD-IP unit.

After installation, you must configure the unit before further operation. Refer to *Chapter 4* for basic and advanced configuration instructions. In case a problem is encountered, refer to *Chapter 7* for test and diagnostics instructions.

Warning

No internal settings, adjustment, maintenance, and repairs may be performed by either the operator or the user; such activities may be performed only by a skilled technician who is aware of the hazards involved. Always observe standard safety precautions during installation, operation, and maintenance of this product.

Note

Before installing the product, review Handling Energized Products *at the beginning of the manual.*

2.2 Site Requirements and Prerequisites

Install AC powered FCD-IP units within 1.5m (5 feet) of an easily accessible, grounded AC outlet capable of furnishing the nominal supply voltage, 115 or 230 VAC. DC powered units require a 24 or -48 VDC power source.

Allow at least 90 cm (36 inches) of frontal clearance for operator access. Allow at least 10 cm (4 inches) clearance at the rear for interface cable connections. The ambient operating temperature of FCD-IP is 0° to 50°C (32° to 122°F), at a relative humidity of up to 90%, non-condensing.

Note

The FCD-IP units are cooled by free air convection therefore in rack installation it is necessary to leave sufficient space (at least 1U) above and below each unit to enable free airflow.

2.3 Package Contents

The FCD-IP package includes the following items:

- FCD-IP unit
- Technical documentation CD
- CBL-RJ45/D9/F/6FT configuration cable
- Interface adapter cable in accordance with the order
- CBL-RJ45/2BNC/E1 (if an unbalanced E1 interface was ordered)
- AC power cable or DC power connection kit
- RM-17 rack mount kit (if ordered).

2.4 Equipment Needed

The cables you need depend on the application. Cables terminated in appropriate connectors provide support for the following data port interfaces:

- V.35 interface: the interface adapter cable ends in a 34-pin female connector
- V.36/422 interface: the interface adapter cable ends in a 37-pin D-type female connector
- V.24/RS-232 or RS-530 interface: the interface adapter cable ends in a 25-pin D-type female connector
- X.21 interface: the interface adapter cable ends in a 15 pin D-type female connector.

2.5 Setting the Internal Jumpers and Switches

There are no internal switches in FCD-IP and all jumpers are preset at the factory in accordance with the installed features.

2.6 Mounting the Unit

FCD-IP is designed for installation as a desktop unit. It can also be mounted in a 19" rack.

- For rack mounting instructions, refer to the RM-17 installation kit manual.
- If FCD-IP is to be used as a desktop unit, place and secure the unit on a stable, non-movable surface.

Refer to the clearance and temperature requirements in *Site Requirements and Prerequisites*.

2.7 Connecting the Interfaces

Figure 2-1 shows a rear panel of a typical FCD-IP unit and identifies the different optional connector locations.

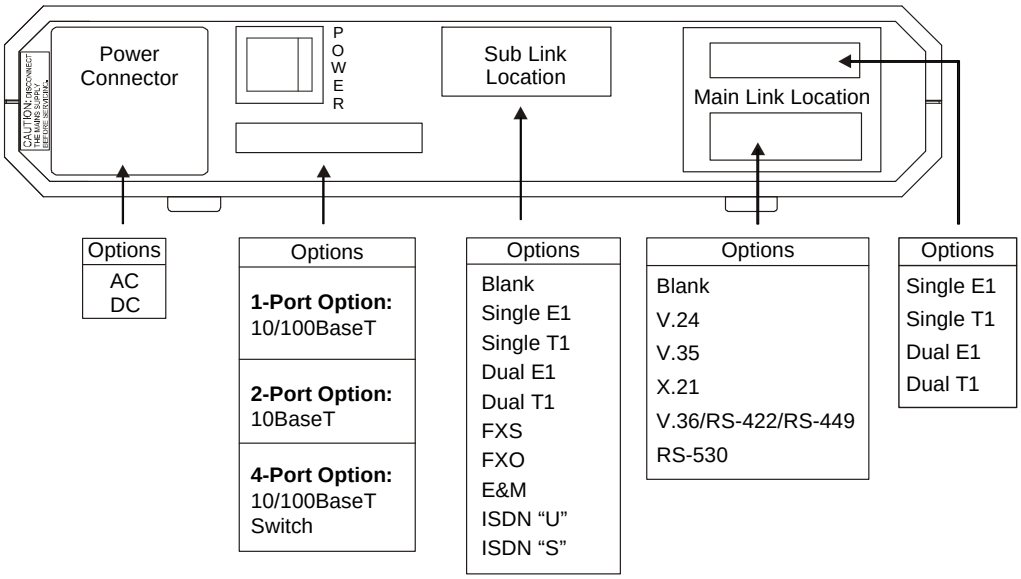


Figure 2-1. FCD-IP Rear Panel

Connecting E1/T1 Interface

FCD-IP E1/T1 link has a RJ-45 8-pin connector for the balanced HDB3 interface. *Appendix A* provides the pin allocation for the RJ-45 connector.

➤ **To connect a balanced E1/T1 link:**

- Connect the E1/T1 link cables to the connector(s) corresponding to the interface in use.

➤ **To connect an unbalanced E1 interface:**

1. Connect the RJ-45 plug of the CBL-RJ45/2BNC/E1 adapter cable to the balanced E1 port on the FCD-IP rear panel.
2. Connect the unbalanced coaxial cables to the appropriate BNC connectors of the CBL-RJ45/2BNC/E1 adapter cable.

Connecting IO Data Channel

The FCD-IP user data port has several possible interface connectors. A listing of the connectors is given in *Equipment Needed* on page 2-2. For more information on pin allocation, refer to *Appendix A*.

➤ **To connect IO data channel:**

- Connect the DTE link cable to the appropriate user data port connector.

Warning

Do not hot swap the FCD-IP modular IO data channel cards. A card must be added to or removed from an IO slot when the power is off ONLY.

Connecting the Control Port

The RJ-45 control port is located on the front panel of the unit.

Caution

Terminal cables must have a frame ground connection. Use ungrounded cables when connecting a supervisory terminal to a DC-powered unit with floating ground. Using an improper terminal cable may result in damage to the supervisory terminal port.

➤ **To connect the control port:**

1. Connect the RJ-45 plug of the CBL-RJ45/D9/F/6F cable to the front panel port designated CONTROL.
2. Connect the DB-9 connector of the CBL-RJ45/D9/F/6F cable to the appropriate port of an ASCII terminal or a PC running terminal emulation software.

2.8 Connecting the Power

For your protection, FCD-IP must always be grounded. Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal can make this instrument dangerous. Intentional interruption is prohibited.

Warning

BEFORE POWERING UP AN AC POWERED FCD-IP, the protective earth terminals of this instrument must be connected to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective ground (earth) contact. The protective action must not be negated by use of an extension cord (power cable) without a protective conductor (grounding).
Make sure that only fuses with the required rated current and of the specified type, as marked on the FCD-IP rear panel, are used for replacement. Use of repaired fuses and short-circuiting of fuse holders is forbidden.
Whenever it is likely that the protection offered by fuses has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

Fuses

The AC version of FCD-IP has a user-replaceable fuse rated at 1A slow blow. The fuse is accessible by opening the fuse cover located just above the power connector on the rear panel.

Caution

Replace fuses only with fuses having identical ratings.

Connecting AC Power

AC power should be supplied to FCD-IP through the 1.5m (5 feet) standard power cable terminated by a standard 3-prong plug.

➤ To connect the AC power:

1. Check that the ON/OFF switch on the FCD-IP rear panel is set to OFF.
2. Connect the power cable to the connector on the FCD-IP rear panel.
3. Connect the power cable to the mains outlet.

Connecting DC Power

➤ To connect the DC power:

- Refer to the DC power supply connection supplement for instructions how to wire the DC adapters, and to the *Handling Energized Products* section.

Chapter 3

Operation

In this chapter you will find detailed operating instructions for FCD-IP. It includes:

- Description of indicators
- Operating procedures (turn-on, front-panel indications, and turn-off)
- Starting a terminal control session.

3.1 Turning On the Unit

In order for the unit to function, you must provide FCD-IP with a setup configuration. You configure the unit after the initial power-up stage.

➤ **To power on FCD-IP:**

- Set the power switch on the rear panel to ON.

  FCD-IP performs a self-test. All the FCD-IP indicators light up. Following the test, all indicators except PWR and READY turn off.

FCD-IP is now ready for configuration. Refer to *Chapter 4* for quick setup and advanced configuration instructions.

3.2 Indicators

Figure 3-1 shows the location of front panel LED indicators.

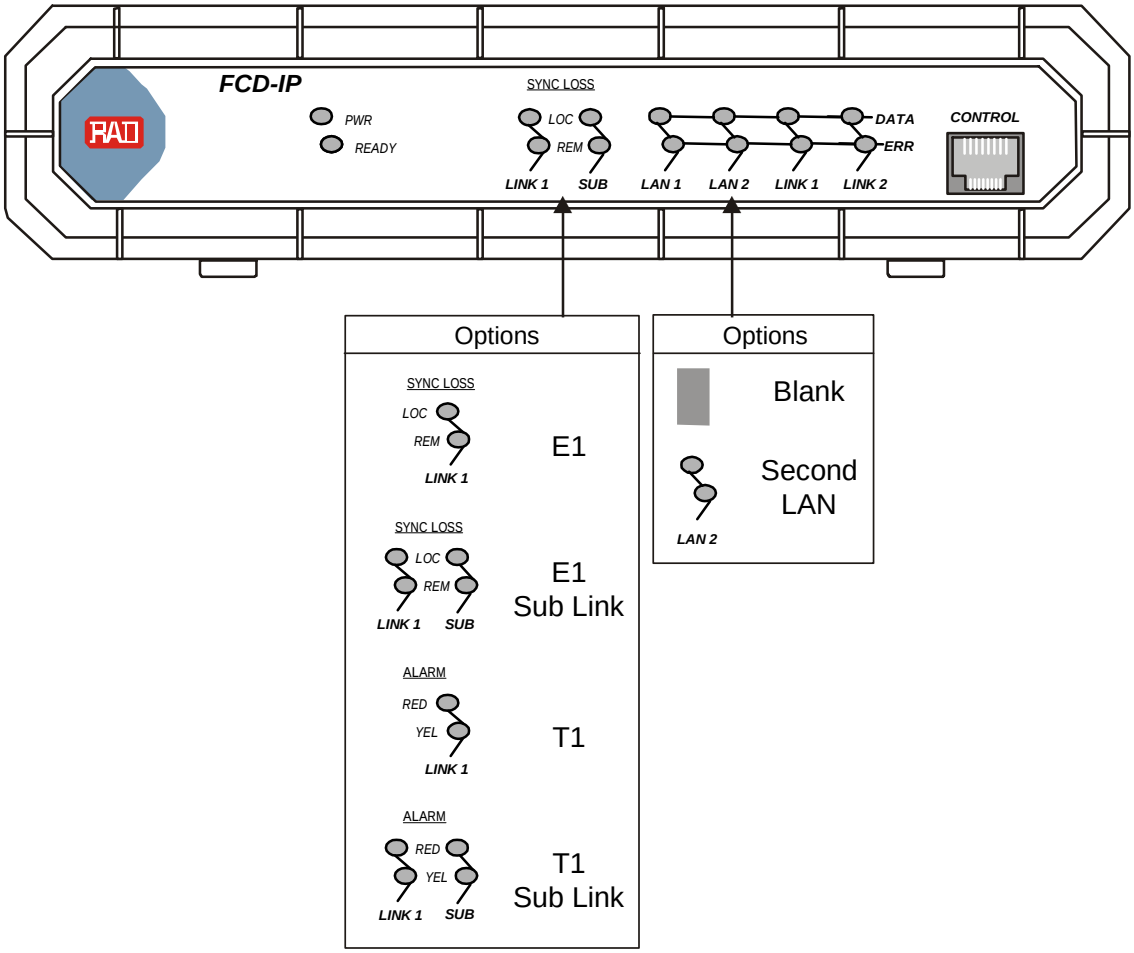


Figure 3-1. FCD-IP Front Panel

Table 3-1 lists the functions of the controls and indicators located on the front panel of FCD-IP.

Table 3-1. Front Panel Indicators

Item	Description	Function
POWER	Green LED	ON – FCD-IP is powered on.
READY	Green LED	ON – Packets can be transferred. Flashing – A loopback is active on E1 or T1 link
LAN 1 DATA LAN 2 DATA	Yellow LED	ON – A packet is received or transmitted on the LAN side.
LAN 1 ERR LAN 2 ERR	Red LED	ON – An error has been detected on a LAN interface
LINK 1 DATA LINK 2 DATA	Yellow LED	ON briefly – A packet is received or transmitted on the link side.

Item	Description	Function
LINK1 ERR LINK2 ERR	Red LED	OFF – Good physical connection and no error are detected on a link interface ON briefly – An error has been detected on a link interface ON continuously – No physical connection is detected
LINK1 RED ALARM	Red LED	ON – Red alarm has been detected at the T1 link (local unit lost frame synchronization for more than 2.5 consecutive seconds)
SUB RED ALARM	Red LED	ON – Red alarm has been detected at a sub-T1 link (a sublink of the local unit lost frame synchronization for more than 2.5 consecutive seconds)
LINK1 YELLOW ALARM	Yellow LED	ON – Yellow alarm has been detected at the T1 link (yellow alarm signal is sent from remote unit to inform the local unit that a red alarm exists at the remote end)
SUB YELLOW ALARM	Yellow LED	ON – Yellow alarm has been detected at a sub-T1 link (yellow alarm signal is sent from remote unit to inform the sublink of the local unit that a red alarm exists at the remote end)
LINK1 LOC SYNC LOSS	Red LED	ON – Local sync loss alarm has been detected at the E1 link (local unit lost frame synchronization for more than 2.5 consecutive seconds)
SUB LOC SYNC LOSS	Red LED	ON – Local sync loss alarm has been detected at a sub-E1 link (sublink of the local unit lost frame synchronization for more than 2.5 consecutive seconds)
LINK1 REM SYNC LOSS	Red LED	ON – Remote sync loss alarm has been detected at the E1 link (remote sync loss signal is sent from remote unit to inform the local unit that a sync loss exists at the remote end)
SUB REM SYNC LOSS	Red LED	ON – Remote sync loss alarm has been detected at a sub-E1 link (remote sync loss signal is sent from remote unit to inform the sublink of the local unit that a sync loss exists at the remote end)

Table 3-2. Rear Panel Indicators

Item	Description	Function
LINK	Green LED	ON – LAN is connected to LAN1 or LAN2 connector or to one of the Ethernet/Fast Ethernet switch ports.
100M	Green LED	ON – LAN speed is 100M OFF – LAN speed is 10M

During normal operation the POWER indicator lights up, and the READY indicator lights up when packets can be transferred. Additional indications are:

- The LAN DATA indicator lights when a packet is received or transmitted on the LAN side
- The LINK DATA indicator lights when a packet is received or transmitted on the LINK side.

3.3 Configuration and Management Alternatives

After installation, there are no special operating procedures for FCD-IP. Once it is powered up, the unit operates automatically. The unit operational status can be monitored constantly.

If required, FCD-IP can be reconfigured. FCD-IP can be managed using different ports and applications:

- Local out-of-band management via an ASCII terminal connected to RS-232 port. Usually, preliminary configuration of the system parameters is performed via ASCII terminal. Once the FCD-IP IP parameters are set, it is possible to access it via Telnet or RADview for further configuration.
- Remote inband management via its link or LAN ports. Remote management is performed using Telnet or RADview, RAD's SNMP-based network management system.

The following functions are supported by the FCD-IP management software*:*

- Viewing system information
- Modifying configuration and mode of operation, including setting system default values and resetting the unit
- Monitoring FCD-IP performance
- Initiating connectivity tests
- Upgrading software.

Configuring FCD-IP via Terminal

FCD-IP includes a V.24/RS-232 asynchronous DCE port, designated CONTROL. The port terminates in a RJ-45 connector located on the font panel. The control port continuously monitors the incoming data stream and immediately responds to any input string received through this port.

➤ To start a terminal control session:

1. Make sure all FCD-IP cables and connectors are properly connected.
2. Connect FCD-IP to a PC equipped with an ASCII terminal emulation application (for example, Windows Hyper Terminal or Procomm) using a CBL-RJ45/D9/F/6FT cable.

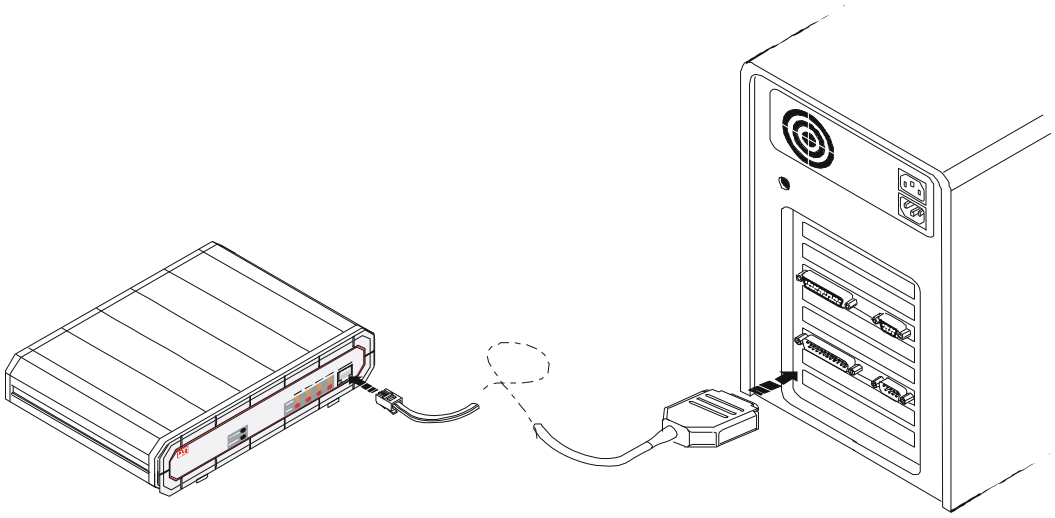


Figure 3-2. Connecting to Terminal Emulator

3. Turn on the control terminal PC and set its port parameters to 9.6 baud, 8 bits, 1 stop bit, no parity.
4. Set the terminal emulator to ANSI VT100 emulation (for optimal view of system menus).
5. When the initialization and self-test are over, press ‹**Enter**› several times to display the **login›** prompt.

Login

To prevent unauthorized modification of the operating parameters, FCD-IP uses password protection.

➤ **To login:**

- Enter correct password at the **login›** prompt. The factory default password is **1234**.

Notes

- *It is recommended to change the default password.*
- *Once the unit has been configured, use the Exit option in the Main menu to end the current control session. This forces personnel requiring access to the unit to use password.*
- *Password verification is case-sensitive.*
- *FCD-IP can be configured to accept user and supervisor passwords. Personnel accessing the unit using a supervisor password are allowed to change all available parameters. Certain menus, such as E1/T1 configuration, are blocked from the regular users.*

Configuring FCD-IP via Telnet

FCD-IP can be managed inband, using Telnet protocol. This requires enabling Telnet management and preliminary configuration of the host IP parameters via an ASCII terminal.

➤ **To prepare FCD-IP for the Telnet management:**

1. Enable Telnet management via the Security menu.
   - Default Telnet user name is **FCD IP**.
   - Default Telnet password is blank.
2. Configure the IP parameters of the FCD-IP host via the Quick Setup menu or any other relevant configuration menu, depending on a management access method or network topology.

Connecting via SNMP Management

The SNMP protocol also operates over IP, therefore all the requirements described above for Telnet management also apply to the connection of SNMP network management stations.

To connect to RAD's SNMP-based network management system, RADview, refer to the *RADview PC-TDM User's Manual for FCD-IP* for instructions.

3.4 Turning FCD-IP Off

➤ **To power off the unit:**

- Set the FCD-IP power switch, on the rear panel of the unit, to OFF.

Chapter 4

Configuration

Topics covered in this chapter include:

- Overview of configuration menus
- Main menu
- Quick setup menu
- Security menu
- Advanced setup menu
- Download software/upload device parameters
- View menu
- Diagnostic tools menu.

4.1 Overview

A chart of the FCD-IP menu tree appears in the following pages.

Note *Depending on the installed hardware, the menu option number may be different from those listed in the menu map.*

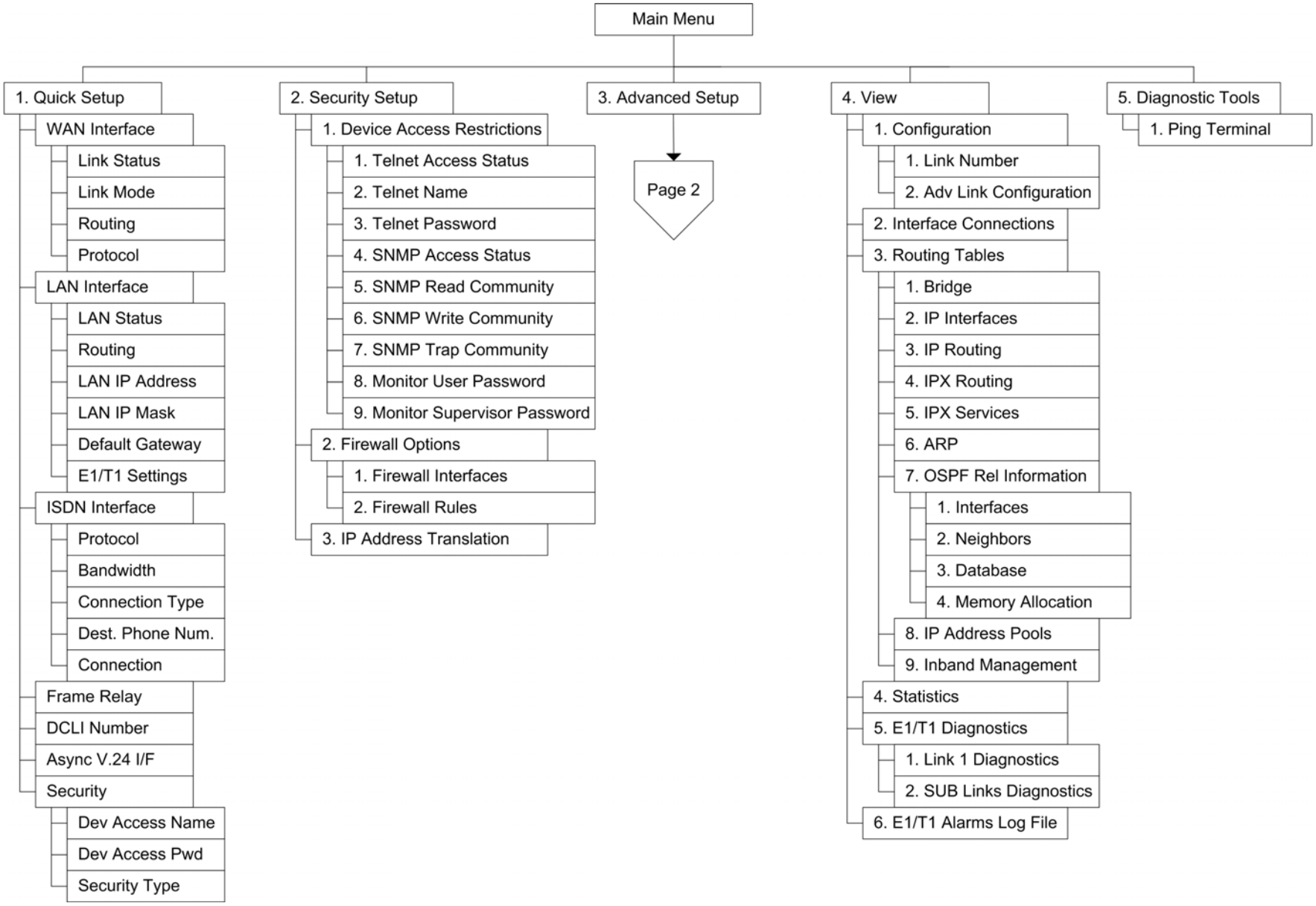


Figure 4-1. FCD-IP Menu Tree – Page 1

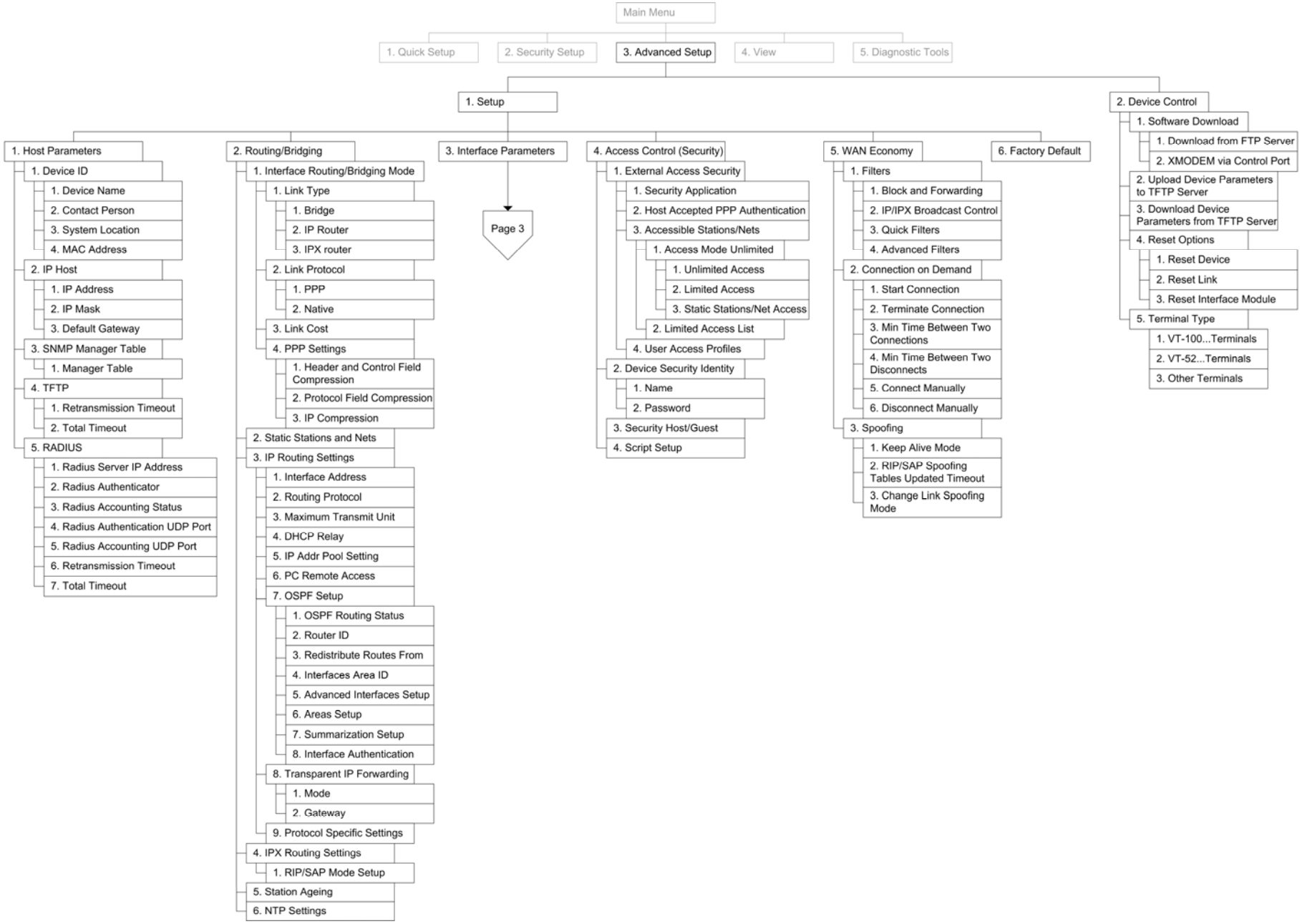


Figure 4-2. FCD-IP Menu Tree – Page 2

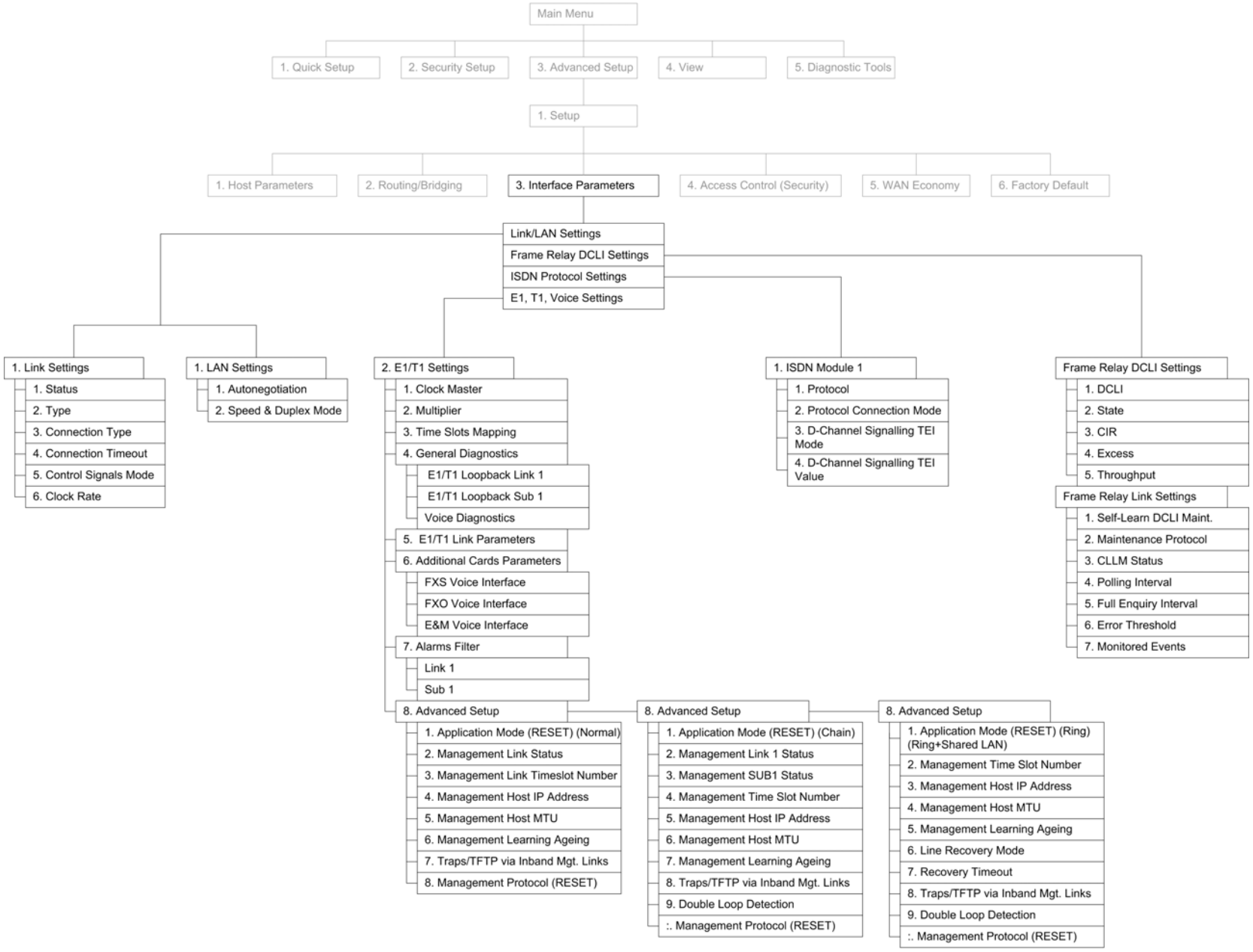


Figure 4-3. FCD-IP Menu Tree – Page 3

The Main menu has the following options:

- Quick setup menu – The Quick Setup menu is used to define the basic parameters for your FCD-IP unit. The Quick Setup menu allows you to adjust setup and link configuration parameters while FCD-IP is in operation. Line-by-line prompts guide you throughout the procedure. On-screen instructions and explanations guide you through the setup procedure. For a complete description of the Quick Setup menu refer to *Section 4.3*.
- Security setup menu – Use the options in the Security Setup menu to control FCD-IP management and entry to your LAN by unauthorized users (refer to *Section 4.4*).
- Advanced setup menu – The Advanced menu lists FCD-IP configuration parameters and their current values. You can change these parameters and perform advanced configuration operations, not available through the Quick Setup menu. Resetting the device and software downloads are also performed via the Advanced Menu (refer to *Section 4.5*).
- View menu – Use the options in the View menu to view configuration screens and information on interface connections, routing tables and statistics.
- Diagnostic Tools menu – Use the Diagnostic Tools menu to verify WAN and LAN connectivity. The Ping feature allows you to request another user on the LAN or WAN. If the remote user replies, connectivity is confirmed up to and including the IP level.
- Exit – Select this option to return to the Operational Status Messages screen. In this mode you can view real-time information about the unit's activities.

4.2 Main Menu

Figure 4-4 shows the Main menu options.

The name of the device connected to the terminal (FCD-IP) is listed at the top of the screen.

➤ **To choose an option from the Main menu:**

Type the number preceding the option.

```
MAIN MENU ( Device name - FCD-IP )
----------
1. Quick setup
2. Security setup
3. Advanced setup
4. View
5. Diagnostic tools

0. Exit
Press number to select or ESC to return to the previous menu
```

Figure 4-4. FCD-IP Main Menu

4.3 Quick Setup Menu

The parameters listed on the Quick Setup Menu include most of FCD-IP's internetworking features:

- WAN interfaces
- IP parameters
- Physical connections
- Protocol
- Routing type.

The Quick Setup screen presents messages that prompt you to accept or modify the current parameters. The parameter options are enclosed in brackets **[ ]**.

➤ **To access the Quick Setup Menu:**

- In the Main menu, press **1**.

  The Quick Setup menu appears, showing the first parameter, Link Status.

➤ **To accept the current parameter:**

- Press <**Enter**>.

➤ **To view the options:**

- Toggle with the spacebar and press <**Enter**>.

➤ **To enter new information:**

1. Type in the new parameters.
2. Press <**Enter**>.

➤ **To change the existing value:**

- Press <**Backspace**>.

After all parameters have been accepted or changed, you can view them on the screen. A confirmation message appears requesting that you confirm all the setup changes. The device may reset after saving these changes.

➤ **To configure the setup parameters:**

1. From the Main menu, select option **1**, Quick Setup.
2. Follow the on-screen instructions to accept or modify the setup parameters.
3. Press **Y** to save the setup parameters.

Quick Setup Parameters

The Quick Setup menu contains both general parameters and those parameters specific to the interfaces installed. This section organizes the parameters into various categories. The screen for each interface and a description of the options in the Quick Setup menu can be found in the sections that follow. Refer to the section that applies to the interface you ordered.

Table 4-1. Quick Setup Parameters

Parameters	Type	Options
WAN Parameters	General	Link status
		Link mode
		Routing
		Protocol
		WAN IP Address (for IP Router only)
		WAN IP Mask (for IP Router only).
	E1/T1	E1/T1 Configuration
	Frame Relay	DCLI number
	ISDN	Protocol (ISDN)
		Bandwidth
		Connection Type
		Channel A – Destination Phone No.
		Channel B – Destination Phone No.
		Connection.
	V24 Async	Modem Type
		Baud Rate
LAN Parameters	General	LAN Status
		LAN IP Address
		LAN IP Mask
		Default Gateway
		Default Gateway Interface
		Routing
	Security Parameters	Device Access Name
		Password
		Security Type

The Quick Setup Menu varies according to the options of FCD-IP that you have ordered. The following pages illustrate some of the Quick Setup menus that are available. The fields in the Quick Setup screens are described below.

Quick Setup Menu Examples

The following pages illustrate some of the Quick Setup menus, dependent upon the interface that has been ordered.

Quick Setup for T1 (PPP, IP)

Figure 4-5 shows the Quick Setup menu for T1.

```
QUICK SETUP
-----------
WARNING: This device automatically exits to Operational
         Messages 10 minutes after last keyboard action without
         saving parameters

'ENTER' - Accept parameter , 'SPACE' - Change parameter.

WAN interface Link 1 - T1
 Link status          : [Enable]
 Link mode            : [Synchronous]
 Routing              : [IP ROUTER], Protocol: [PPP]
 WAN IP address       : 10.0.0.1, enter new : 10.0.0.1
 WAN IP mask          : 255.255.255.252, enter new: 255.255.255.252
 Do you want to configure the T1 Interface parameters (Y/N)?:
Host IP setup:
 LAN Status           : [Enable]
 LAN IP address       : 192.168.1.1, enter new : 192.168.1.1
 LAN IP mask          : 255.255.255.000, enter new : 255.255.255.000
 Default gateway setting by: [Interface]
 Default gateway interface: 1
SECURITY Setup
 Device access name   : FCD-IP
 No password at present – do you want to create password (Y/N)?: [N]
 Security type        : [Disabled]

Saving the changes might cause RESET the unit.
Do you want to save QUICK SETUP (Y/N)? Y
```

Figure 4-5. T1 Interface Quick Setup Screen

Quick Setup for E1 (PPP, IP) + ISDN (Backup, 128K, PPP, IP)

Figure 4-6 shows the Quick Setup menu for E1.

```
 QUICK SETUP
 -----------
 WARNING: This device automatically exits to Operational
          Messages 10 minutes after last keyboard action without
          saving parameters
 'ENTER' - Accept parameter , 'SPACE' - Change parameter.
 WAN interface Link 1 - E1
  Link status          : [Enable]
  Link mode            : [Synchronous]
  Routing              : [IP ROUTER], Protocol: [PPP]
  WAN IP address       : 10.0.0.1, enter new : 10.0.0.1
  WAN IP mask          : 255.255.255.252, enter new: 255.255.255.252
  Do you want to configure the E1 Interface parameters (Y/N)?:
 WAN interface Link 2/CH1 – BRI
  Link status          : [Backup] to interface: [LINK 1]
  Routing              : [IP ROUTER], Protocol: [PPP]
  WAN IP address       : 0.0.0.0, enter new : 0.0.0.
  Protocol             : [ETSI]
  Bandwidth            : [128]
  Connection Type      : [Originate only]
  Channel A – Destination phone number: 1234
  Channel B – Destination phone number: 5678
  Connection           : [Always]
Host IP setup:
  LAN Status           : [Enable]
  LAN IP address : 192.168.1.1, enter new : 192.168.1.1
  LAN IP mask    : 255.255.255.000, enter new : 255.255.255.000
  Default gateway setting by: [Interface]
  Default gateway interface: [LINK 1]
 SECURITY Setup
  Device access name : FCD-IP
  No password at present – do you want to create password (Y/N)?: [N]
  Security type: [Disabled]

 Saving the changes might cause the unit to RESET.
 Do you want to save QUICK SETUP (Y/N) ? N
```

Figure 4-6. E1 Interface Quick Setup Screen

Configuring the WAN Interface

Set this parameter for the WAN configuration.

Table 4-2. WAN Parameters

Parameters	Possible Values	Description
Link Status	Enable	Transmits and receives frames.
	Disable	Does not transmit or receive frames. The link may be permanently disabled, for example, when testing. A disabled line freezes all link operation, including connection attempts and forwarding.
	Backup	If a link is defined as backup to another, then whenever the main link operates normally, the backup link is *disabled*. If the main link fails, the backup link begins to operate and become *enabled*. You must make sure that the routing settings are correct so that traffic will be forwarded to the desired destination via the backup link. When you restore the main link connection, the backup link becomes *disabled* again. **Default : Enable**
Link Mode	Synchronous	Data bits are transmitted at a fixed rate. The sender and the receiver are synchronized
	Frame Relay	A packet-switching protocol for connecting devices on a WAN.
	Asynchronous	Data bits are transmitted at a fixed rate. The sender and the receiver are not synchronized.
Routing	IP, IPX, Bridge Any combination of these link types.	Assigns the link forwarding type.

Table 4-2. WAN Parameters

Parameters	Possible Values	Description
Protocol	PPP	Point to Point Protocol. PPP consists of 3 components: **Encapsulation method** – for IP datagrams on a serial link PPP supports HDLC synchronous links. **LCP** – Link control procedure to establish, configure, and test the data-link connection. Having an LCP allows each end to negotiate various options. **NCP(s)** – A family of network control protocols specific to different network layer protocols. The NCPs allow each end to configure network control parameters. PPP is often used across slow serial lines. It is therefore important to reduce the number of bytes per frame in order to reduce the latency time. Using LCP, most implementations negotiate to omitting the constant address and control fields and reducing the size of the protocol fields from 2 bytes to 1 byte. In addition, when using IP NCP, most implementations use Van Jacobson header compression to reduce the size of IP and TCP headers.
	RFC-1490	Encapsulation method for carrying network interconnect traffic over a Frame Relay backbone. RFC-1490 also supports a simple fragmentation procedure for carrying large frames over a frame relay network with a smaller MTU. **DLCI –** Every network interface card (NIC) has a Data Link Communication Identifier (DLCI) that uniquely identifies the node on the network. DLCI enables connection to the Frame Relay network without configuring Frame Relay parameters. DLCI executes congestion control when an explicit congestion notification is received for the DLCI from the Frame Relay network. The unit reduces the transmitted information rate of the DLCI and increases it when the congestion condition is cleared. **Default : PPP**
DLCI Number		Sets the DLCI identification number.

Configuring the LAN Interface

Set the parameters in this section for each LAN connection.

Table 4-3. LAN Parameters

Parameters	Possible Values	Description
LAN Status	Enable Disable	Transmits and receives frames Does not transmit or receive frames. Used by system administrator **Default : Enable**
Routing		Select this parameter to set the routing option. ***Note:*** *This parameter appears for the 2-LAN device only.*
LAN IP Address	Class A 1.0.0.0 to 127.255.255.255, Class B 128.0.0.0 to 191.255.255.255, Class C 192.0.0.0 to 223.255.255.255, Class D 224.0.0.0 to 239.255.255.255 Class E 240.0.0.0 to 247.255.255.255	Select this parameter to enter the IP address. Every device on a TCP/IP network must have an identification address. The IP address is a value consisting of the network address and the host address on that network. The value assigned to a network depends on the number of computers on that network. The IP address is a 32-bit number. The number consists of 4 parts, where each part consists of 3 digits. One part of the address identifies the network and another part of the address identifies the host. The numbers in the address, which identifies the host, depend on the class. There are 5 classes of IP addresses. Each class represents a network having a certain number of computers. For example, a Class C address is given to a network having between 1 to 255 computers. The numbers in each part of the code are translated into binary. The binary code identifies the network and the host. IP addresses are assigned by the Internet Network Information Center (InterNIC). InterNIC assigns the network ID. Host IDs are assigned by the network administrator.
LAN IP Mask		Select this parameter to enter the IP mask. The mask is configured automatically from the IP address class. If you want to change the default mask, enter a new mask. For example, the IP mask is usually 225.225.225.0. A mask like this would allow 254 hosts on the LAN. If you want to create a subnet, which allows 6 users, including FCD-IP, configure the mask as 225.225.225.248. on FCD-IP, as well as each host included on the subnet (refer to *Figure 4-7*).

Table 4-3. LAN Parameters (Cont.)

Parameters	Possible Values	Description
Default Gateway Setting		Select this parameter to set the Default Gateway configuration (see *Figure 4-7*). The default gateway is the address to which frames are sent, if no other address is defined in the routing table. The default gateway can be an IP address or a WAN interface. If you choose to use an IP address, enter the address of the router, which will deliver the frames. Specifying an IP address for the default gateway is done with shared media, such as LAN interface. If you choose to use a WAN interface, the connection to the router is point-to-point. Choose by interface and enter interface/DLCI number (for Frame Relay). ***Warning**: It is very important to obtain the correct parameters from the system administrator or ISP. The most common problem when establishing an IP connection is incorrect configuration of the IP parameters and Default Gateway. **Do not** try to guess these parameters.*
E1/T1 Settings		Prompts to perform advanced configuration on the main link settings – E1 or T1, depending on your unit. By entering **YES** you are sent into the Advanced Configuration menu. For more information, refer to *Chapter 5*.

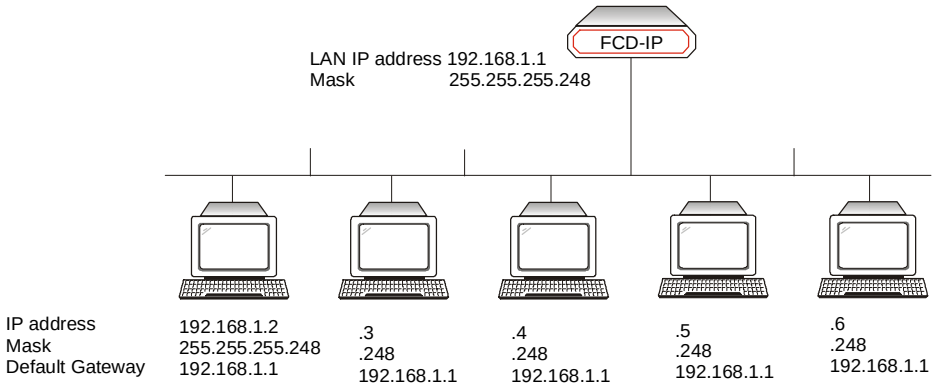


Figure 4-7. Setting up the IP Mask

Configuring the ISDN Interface

FCD-IP is available with ISDN "S" and "U" options.

Table 4-4. ISDN Settings

Parameters	Possible Values	Description
Protocol (ISDN)		Assigns the protocol provided by the ISDN service in your area. Some additional parameters may be requested depending on the selected protocol.
Bandwidth	56, 64, 112, 128 kbps	Assigns a bandwidth. The bandwidth is the rate at which data passes through the link. The greater the bandwidth, the more information can be sent through the link. FCD-IP allows you to work with a bandwidth of 56, 64, 112, or 128 kbps. Selection of 112 or 128 kbps for protocols other than IDSL means MLPPP will be invoked.
Connection Type		Specifies the type of connection used to connect to the Internet or Intranet.
	Answer only	If the link is to be used only for receiving incoming connections
	Answer&Originate	If the link is to be used for both incoming and out going connections (not simultaneously)
	Originate only	If the link is to be used for outgoing connections only.
Destination Phone Number		Defines the phone number used to connect to the Internet or Intranet. To edit the phone number, erase the number with the Backspace key and enter the new number. This parameter appears only when the connection type is **Originate only** or **Answer&Originate**.
Connection		Determines when the link between the local LAN and the Internet should be activated. Selecting any frame for forwarding, activates the link only when there is traffic to be sent on the link. Selecting Always keeps the link active, independent of traffic. The Connection parameter is important in reducing operating costs.

Configuring the Frame Relay Connections

You need to set the DCLI number, to allow connection to the Frame Relay network without setting Frame Relay parameters.

Selecting the DLCI Number

Select this parameter to set the DLCI number.

Configuring Asynchronous V.24 Interface

Two settings that must be made.

Table 4-5. V.24 Async Settings

Parameters	Description
Modem Type	Select this parameter to select the modem type.
Baud Rate	Select this parameter to display the rate at which data is sent between FCD-IP and the modem. Use the spacebar to toggle between the different baud rates. The Quick Setup default value is recommended for your modem.

Configuring Security Options

This feature provides protection from unauthorized access through the Internet.

Table 4-6. Security Settings

Parameters	Description
Device Access Name	Display the name assigned to FCD-IP for identification by the ISP. To change the device access name, type in the new name and press Enter.
Device Access Password	Assign or updates a password. The password is used to access the Internet.
Security Type	Permits access to all users (disable) or restrict access to allow/deny users whose profiles are defined (enable) in the system.

4.4 Configuring Security

Topics covered in this section include:

- Enabling Telnet access
- Enabling SMNP access
- Enabling/disabling the Solid Firewall
- Changing the login password
- IP Address translation (NAT).

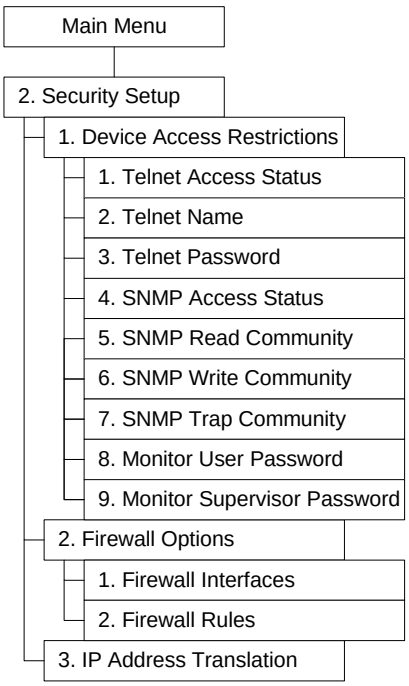


Figure 4-8. Security Setup Menu Outline

The Security Setup menu allows you to control access to FCD-IP and access to the LAN. FCD-IP is protected against unauthorized user access by disabling access via SNMP and TELNET. The Solid Firewall is used to protect the LAN against undesired entry.

➤ **To access the Security Setup Menu:**

- Follow the screen path: **Main Menu > Security Setup**

The Security Setup menu appears (refer to *Figure 4-9*).

```
SECURITY SETUP  ( Device name - FCD-IP )
--------------

1. Device access restrictions
2. FIREWALL options
3. IP address translation

ESC - Return to previous menu

Choose one of the above:
```

Figure 4-9. Security Setup Menu

The Security Setup options are described below.

Restricting Access to FCD-IP

Parameters listed on this screen allow you to control access to FCD-IP configuration from the control port or from LAN/WAN (via Telnet and SNMP).

Enabling Telnet Access

FCD-IP supports Telnet. This allows FCD-IP to be configured and controlled over the WAN and LAN using TCP/IP.

Access to Telnet requires authentication by the device, using username and password.

By default, Telnet access to FCD-IP is disabled to prevent changes being made to the unit's configuration parameters.

➤ **To enable Telnet access:**

1. From the **Security Setup** menu, select option **1**, Device Access Restrictions.
2. From the **Device Access Restrictions** menu, select option **1**, Telnet Access Status and change it to **Enable**.
3. Select options **2** and **3** to change the **User name** and **Password**, if required.

FCD-IP can now be accessed using your TELNET username and password.

Enabling SNMP Access

By default, access to FCD-IP via SNMP is disabled. Blocking SNMP access prevents changes being made to the unit's configuration parameters.

➤ **To enable SNMP access:**

1. From the **Security Setup** menu, select option **1**, Devise Access Restrictions.
2. From the **Devise Access Restrictions** menu, select option **4**, SNMP Access Status and change it to Enable.
3. Select options **5**, **6**, and **7** to change **Read, Write and Trap communities**, if required.

FCD-IP can now be accessed for SNMP operation using the appropriate communities.

Changing Login Password

Entrance to configuration screens, via terminal from the control port, is set by the factory default as *Protected by Password*. The default password is *1234*.

➤ **To change the password or remove password protection:**

1. From the **Security Setup** menu, select option **1**, Device Access Restrictions.
2. From the **Device Access Restrictions** menu, select option **8**, Monitor User Password.
3. Enter a new value for the **Password**.

Configuring Supervisor Access

FCD-IP has the option of dual–level password access. This allows certain menus to be blocked from a regular user, while permitting a supervisor to access and alter the parameters of these menus. To use this option, set a Monitor Supervisor Password.

➤ **To set a monitor supervisor password:**

1. From the **Security Setup** menu, select option **1**, Device Access Restrictions.
2. From the **Device Access Restrictions** menu, select option **9**, Monitor Supervisor Password.

Note *Leaving Password blank removes login protection.*

Configuring Firewall

Solid Firewall is a rule-based security mechanism, which monitors incoming and outgoing traffic and allows or restricts access according to the user-defined criteria (rules).

You can configure the Solid Firewall to monitor incoming or outgoing traffic on any WAN and LAN link. The firewall blocks all traffic coming from the unprotected network segment to the protected section, and allows traffic from protected to unprotected segments. Only those applications that are enabled via the application list (e.g. HTTP, FTP, POP3 servers, etc.) are allowed for use. By default, the Solid Firewall is disabled.

➤ **To select the Solid Firewall interface and direction:**

1. From the **Main menu**, select option **2**, Security Setup.
2. From the **Security Setup** menu, select option **2**, Firewall Options.

   The Firewall Setup menu appears (see *Figure 4-11*).
3. From the **Firewall Setup** menu, type **1**.

   The Firewall Interface menu appears (see *Figure 4-12*).
4. From the **Firewall Interface** menu, type **A** and define the link on which you intend to set the firewall and traffic type to monitor:
   - **Inbound** – The firewall blocks the traffic coming into FCD-IP via the link on which the firewall is enabled. The firewall forwards the traffic going out of the firewall-protected interface to its destination.
   - **Outbound** – The firewall blocks the traffic going out of FCD-IP via the link on which the firewall is enabled. The firewall grants access to the traffic coming into FCD-IP from the network segment attached to the firewall-protected interface.
5. Press ‹**Esc**› and save new values.

➤ **To define the Solid Firewall rules:**

1. From the **Firewall Setup** menu, type **2**.

   The Firewall Rules menu appears (see *Figure 4-13*).
2. From the **Firewall Rules** menu, type **A** and perform the following:
   - Define a link on which the rule will be applied
   - Specify the source IP address range by defining the start and end addresses.

- Specify the destination IP address range by defining the start and end addresses.
- Enable the application used by the rule (**user defined**, **Telnet**, **Ping**, **HTTP**, **FTP**, **TFTP**, **POP3**, **SMTP**, **SNMP**, **SNMP Trap**, **BOOTP/DHCP**, **DNS Client to Server**, or **DNS Server to Server**).
- If you select a user-defined application, you must specify the following parameters:
  - Protocol type: **TCP**, **UPD** or **ICMP**
  - **Minimum** and **maximum port value** for TCP and UDP protocols, or **ICMP message type** for ICMP protocol.

3. Press <**Esc**> and save new firewall rule values.

   For example, two LANs are connected to the FCD-IP 10BaseT ports (see *Figure 4-10*). LAN 1 includes company's Web, mail and FTP servers, which cab be accessed from the outside. Employees' PCs sitting on LAN 2 must not be reached from the outside, but they must be allowed to access the servers. In order to grant access to LAN 1 and restrict it to LAN 2, you must set up two firewalls:

   Firewall 1

   - Select interface – main link
   - Select direction – inbound
   - Define rule 1 for Web server:
     - Start and end source IP address – 0.0.0.0 to 255.255.255.255
     - Start and end destination IP address – 192.111.111.111
     - Protocol – HTTP.
   - Define rule 2 for mail server, which is identical to rule 1, except for destination IP addresses (192.111.111.112) and protocol (SMTP).
   - Define rule 3 for FTP server, which is identical to rule 1, except for destination IP addresses (192.111.111.113) and protocol (FTP).

   Firewall 2

   - Select interface – LAN 2
   - Select direction – outbound.

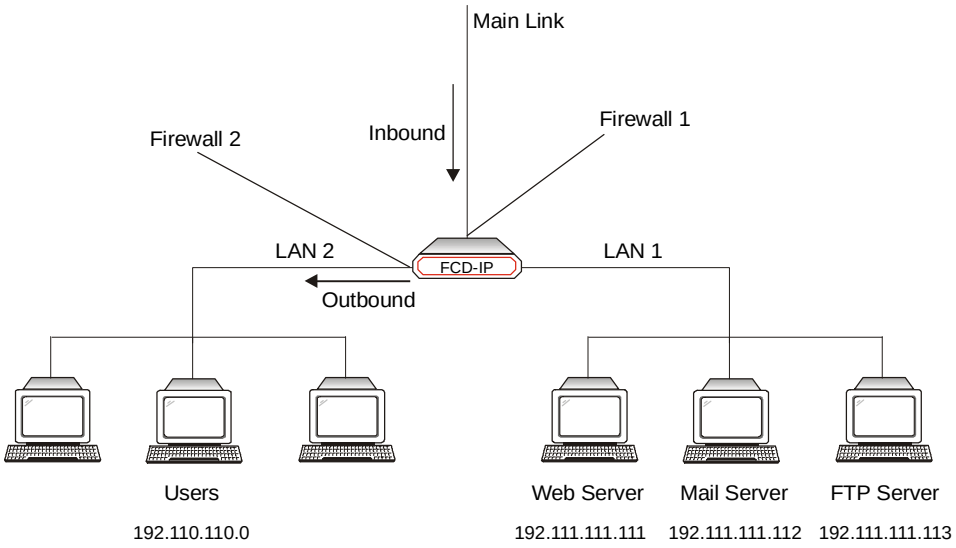


Figure 4-10. Configuring Firewalls

➤ **To access the Firewall Setup menu:**

- Follow the screen path: **Main Menu > Security Setup > Firewall Setup**

```
FIREWALL SETUP  ( Device name - FCD-IP )
--------------
    1.  FIREWALL Interfaces
    2.  FIREWALL Rules

    ESC - Return to previous menu

    Choose one of the above:
```

Figure 4-11. Firewall Setup Menu

➤ **To access the Firewall Interfaces menu:**

- Follow the screen path: **Main Menu > Security Setup > Firewall Setup > Firewall Interfaces**

```
FIREWALL INTERFACES  ( Device name - FCD-IP )
-------------------
    Interface      Direction

    OPTIONS: A-Add

Press one of the above or ESC to return to previous screen:
       Select interface: [LINK 1    ]
       Select Direction: [Inbound  ]
```

Figure 4-12. Firewall Interfaces Menu

➤ **To access the Firewall Rules menu:**

- Follow the screen path: **Main Menu > Security Setup > Firewall Setup > Firewall Rules**

```
 FIREWALL RULES  ( Device name - FCD-IP )
 --------------
     Interface      Direction

OPTIONS: A-Add

Press one of the above or ESC to return to previous screen:
   Select interface: [LINK 1    ]
   Enter start source IP address: 000.000.000.000
   Enter end source IP address  : 222.222.222.222
   Enter start destination IP address   :
   Enter end destination IP address     :
   Select application type: [Telnet       ]
```

Figure 4-13. Firewall Rules Menu

Configuring IP Address Translation (NAT)

IP Address Translation allows a NET that uses a private IP Address to connect to the Public Internet/Intranet (Single IP is one of the IP Address Translation types).

➤ To access the IP Address Translation menu:

- Follow the screen path: Main Menu > Security Setup > IP Address Translation

```
IP ADDRESS TRANSLATION ( Device name – FCD-IP )
----------------------
   Type    Interface   Status                    Range

OPTIONS: A-Add
Press one of the above or ESC to return to previous screen:
```

Figure 4-14. IP Address Translation Menu

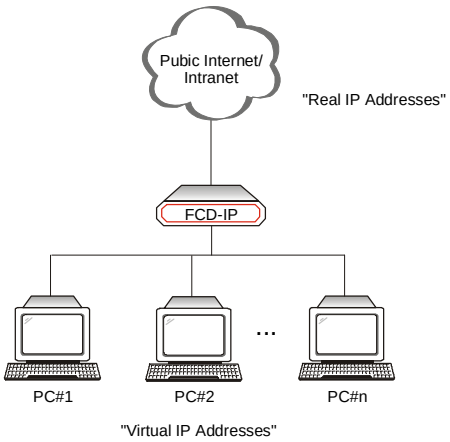


Figure 4-15. IP Address Translation

IP Address Translation permits some, or all, PCs on your private LAN to be represented with legal IP Addresses that are defined on the internet/Intranet (refer to *Figure 4-15*).

FCD-IP supports the IP Address Translation types listed in *Table 4-7*.

Table 4-7. IP Address Translation (NAT) Settings

Parameters	Description
Static Single	A PC with its Virtual Address specified will have access to the Internet/Intranet with a legal, real IP Address. Bidirectional one-to-one access is allowed.
Static Range	PCs with their Virtual Addresses within the specified range will have access to the Internet/Intranet with a legal, real IP Address range. Bidirectional N-to-N access is allowed.
Concurrent	A number of PCs (n) with their Virtual Addresses within the specified range will have access, but only some of them (m) can work simultaneously (m<n). The application must be started from the private LAN.
Transparent	Address translation is not performed for a specified range of IP Addresses. This setup may be used for the application shown in *Figure 4-16*.
PAT (Port Address Translation)	FCD-IP connects a UDP or TCP port to a specified IP address. PAT is available for single IP only.
Single IP	The whole Private LAN is represented as a single legal IP Address on Internet/Intranet.

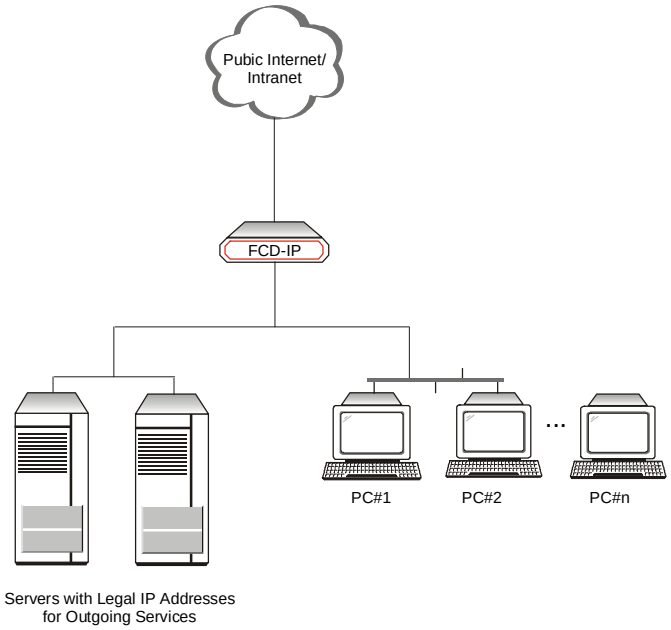


Figure 4-16. IP Address Transparent

Note

For Static and Concurrent Address Translation, all PCs on your LAN with IP Addresses not covered by the listed definitions will not obtain access to the Internet/Intranet.

You may enter more than one entry of each type.

Each definition in a list may be Enabled or Disabled separately.

4.5 Configuring Device Control

The Advanced Menu contains the majority of FCD-IP configuration parameters. You can change these parameters and perform advanced configuration operations that are not available through the Quick Setup menu. Resetting FCD-IP and software downloads are also performed via the Advanced Menu.

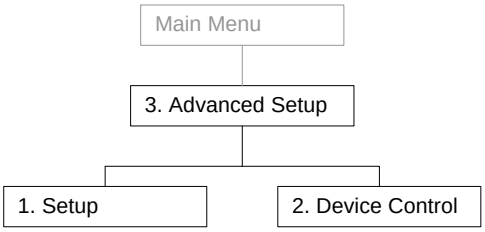


Figure 4-17. Advanced Menu Outline

➤ **To access the Advanced Menu:**

- In the **Main Menu**, press **3**.

  The Advanced Menu appears (refer to *Figure 4-18*).

```
ADVANCED MENU ( Device name - FCD-IP )
-------------
1.  Setup
2.  Device control
ESC - Return to previous menu

Choose one of the above:
```

Figure 4-18. Advanced Menu

The options in the Advanced Menu are:

- **Setup** - used to modify setup parameters
- **Device Control** - used to download the software and parameters, and perform reset operations.

These options are described in the sections below.

Setup Menu

Refer to *Chapter 5* for a detailed description of this option.

Configuring Device Control Options

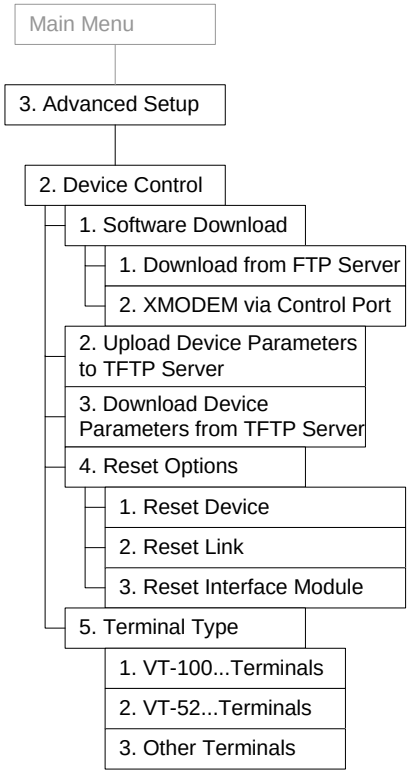


Figure 4-19. Device Control Menu Outline

➤ To access the Device Control menu:

- Follow the screen path: Main Menu > Advanced Setup > Device Control

```
DEVICE CONTROL ( Device name - FCD-IP )
 --------------
1. Software download
2. Upload device parameters to TFTP server
3. Download device parameters from TFTP server
4. Reset options
5. Terminal type

ESC - Return to previous menu
Choose one of the above:
```

Figure 4-20. Device Control Menu

The options in the Device Control menu are described below.

Downloading Software

Select this option to download a new software version.

➤ To access the Software Download menu:

- Follow the screen path: Main Menu > Advanced Setup > Device Control > Software Download

```
SOFTWARE PARAMETERS IN THE DOWNLOAD ( Device name-FCD-IP )
----------------------------------
1. Download from TFTP Server
2. XMODEM via control port (BOOT Manager)
3. Download software to ISDN module

ESC - Return to previous menu
Choose one of the above:
```

Figure 4-21. Software Download Menu

FCD-IP includes a Dual Image Flash, capable of storing two different versions of software in two different partitions.

Upon reset (or boot, refer to *Appendix B*), FCD-IP automatically runs the program stored in the active partition.

New software versions are loaded into the backup partition. If loading succeeds, the backup partition becomes **active** and reset is automatically performed, running the new software version. If loading fails, however, the device will still be capable of working, since the Flash partition storing the old version is still active. Refer to *Figure 4-22*.

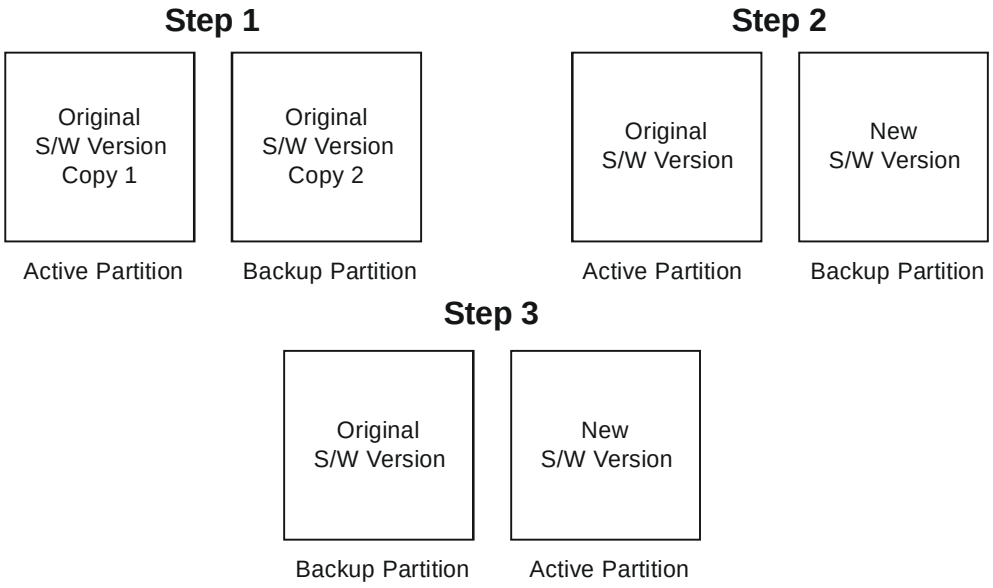


Figure 4-22. Using the Dual Image Flash

Control Dual Image Flash by the BOOT Manager. You use the BOOT Manager to manually define active and backup partition, run backup partition, erase some or all information from Flash etc. The BOOT Manager is accessible via the above menu or immediately after resetting the hardware. Refer to Appendix C for a detailed description of the BOOT Manager.

The options in the Software Download menu are described below.

Downloading from TFTP Server

TFTP is an IP/UDP client-server application. The unit is a TFTP client. Operating opposite the client, you need a TFTP server connected to the LAN or WAN interface via an IP network.

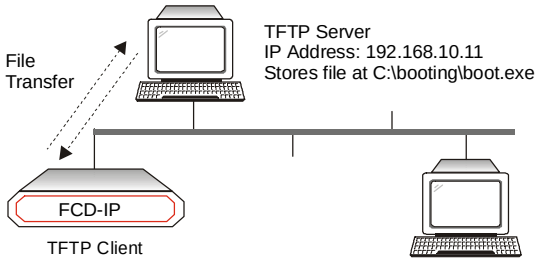


Figure 4-23. Downloading from a TFTP Server

➤ To access the Software Download menu:

- Follow the screen path: Main Menu > Advanced Setup > Device Control > Software Download > Download from FTP Server

```
Do you want to download new software version? (y/n): Y

TFTP server IP address: 192.168.182.34
New software file name: fcdip.mbi

Download process will erase the program code
in the second partition of the device.

Upon completion of the download,
the device will be reset automatically.

Press 'S' to start the download process
or
ESC to return to previous menu:
```

Figure 4-24. Software Download Menu

1. Confirm that the Do You Want To Download New Software Version field is set to Yes.
2. In the TFTP Server IP Address field, type the IP address of the TFTP server.
3. In the New Software File Name field, type the path and file name of the new software version.

Note *The IP address and the new software version file name can also be defined through the Setup menu. Refer to* Setup *at the beginning of the chapter.*

4. Press S to start the download process.

   During the process, the new program code is downloaded to the Flash backup partition, thus erasing its previous contents.

   Upon completion, the newly downloaded Flash partition becomes active, while the old version's partition becomes backup. The device automatically resets, running the new program stored in the active partition.

During the download process, a counter shows the number of packets that have passed. Downloading can be interrupted at any time by pressing the ESC key.

Downloading Using XMODEM via Control Port (BOOT Manager)

Use this option to access the BOOT Manager via the control port. Refer to *Appendix B* for more information on the Boot Manager.

Uploading Device Parameters to TFTP Server

Select this parameter to save device configuration parameters into a file by uploading to the TFTP server. This operation sends all unit parameters to the TFTP server and will be saved under a file name that you specify.

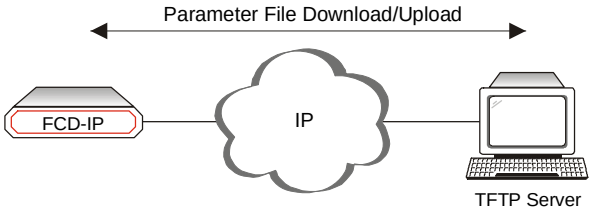


Figure 4-25. Downloading/Uploading Parameters

➤ **To upload device parameters:**

1. Activate the TFTP server application connected to the unit via an IP network.
2. Configure the following IP parameters: IP address, IP mask and IP default gateway.
3. Select the TFTP upload option.
4. Enter the TFTP server IP address.
5. Assign a name to the configuration file you want to save on the server, for example V35_file.
6. Press **S** to start the upload process.

Downloading Device Parameters from TFTP Server

Select this option to load device configuration parameters from a file by downloading from the TFTP server.

➤ **To download device parameters:**

1. Activate the TFTP server application connected to the unit via an IP network.
2. Configure the following IP parameters: IP address, IP mask and IP default gateway.
3. Select the TFTP download option.
4. Enter the TFTP server IP address.
5. Enter the name of the configuration file you want to download from the server, for example V35_file.
6. Press **S** to start the download process.

Note *Upon completion of the download process, the unit performs reset. The new parameters only come into effect after resetting.*

Resetting FCD-IP

Select this option for resetting the device, link, or interface module.

Selecting Terminal Type

Select this option to choose a terminal type. Since each terminal type uses different ASCII control codes for cursor control, FCD-IP requires this information to display the screens clearly. This setting affects the Statistics screen display only.

4.6 Viewing FCD-IP Configuration and Status

Use the View menu options to see information on interface connections, routing tables, statistics, diagnostics, and alarms.

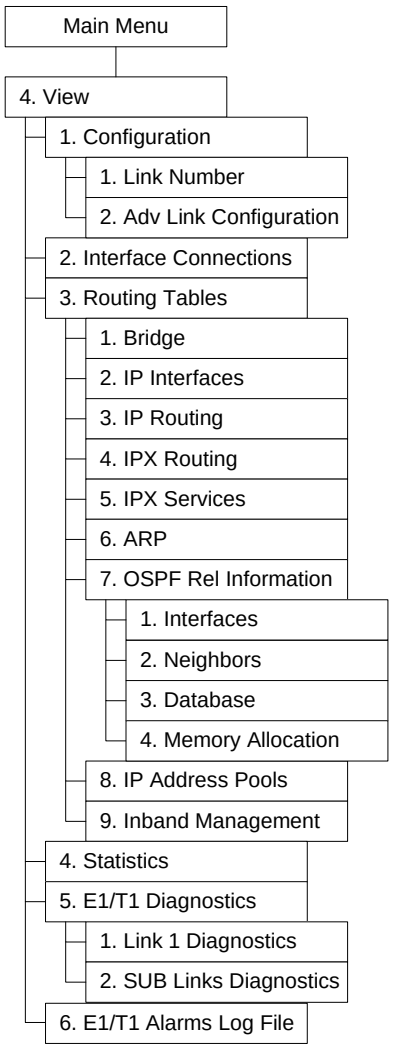


Figure 4-26. View Menu Outline

➤ To access the View Menu:

- Follow the screen path: Main Menu > View

The options in the View Menu are described in this chapter.

```
VIEW MENU ( Device name - FCD-IP )
---------
1. Configuration
2. Interface Connections
3. Routing Tables
4. Statistics
5. E1/T1 Diagnostics
6. E1/T1 alarms log file


Press number to select or ESC to return to the previous menu:
```

Figure 4-27. View Menu

Displaying FCD-IP Configuration

Select this option to view the configuration parameters for the device and link that were entered through the Setup menu. The View Configuration screen displays the general unit configuration and parameters such as names, addresses and link types (including link baud rate and status). When typing the interface number, detailed information on the interface appears. Since these screens are "display-only" you cannot use them to adjust parameters.

➤ To access the View Configuration screen:

- Follow the screen path: Main Menu > View > Configuration

```
 VIEW CONFIGURATION ( Device name - FCD-IP )
 ------------------
 Device type            : FCD-IP
 Contact person         : name of contact person
 System location        : the location of this device
 Hardware version       : 2.1
 Software version       : 4.00 (2004-10-10)
 Hosp IP address        : 172.17.161.83

   Name       Interface   Type/Mac address   Clock(Kbps)   Status   Mode
   -----      ----------  ----------------   -----------   ------   ----
1. LAN Switch Ethernet    0020 D2221 82AD    10/100 (Mbps) Enabled  Bridge
2. LINK 1     T1          Synchronous        Internal/0    Enabled  Bridge
3. LINK 2     V.24  DTE   Synchronous        External/19.2 Enabled  Bridge

 Main link fractional TDM services:
 LINK 1 + SUB1 + FXS

  Press number for more information on interface or any key to exit :
```

Figure 4-28. View Configuration Screen

Displaying Interface Connections

This screen displays the connection status for all FCD-IP LAN and WAN interfaces. The information includes physical connections like E1, subE1 V.35, ISDN and logical connections like DLCIs in Frame Relay. Each row in the screen shows the last successful channel synchronization.

➤ To access the Interface Connections screen:

- Follow the screen path: Main Menu > View > Interface Connections

```
INTERFACE CONNECTIONS  ( Device name - FCD-IP )
---------------------
                     ROUTING           CONNECTION
INTERFACE             TYPE               STATUS         MORE INFORMATION
-----------  ------------------------  --------------  -----------------
LAN Switch    Bridge                    open
LINK 1        Bridge PPP                RED alarm
SUB 1                                   RED alarm
LINK 2        Bridge PPP                Sync not obtained
MNG LINK 1    Mngmnt PPP                disable


R - Refresh
ESC - Return to previous menu
```

Figure 4-29. Interface Connections Screen

Viewing Routing Tables

Select this option to display different routing tables.

➤ To access the Routing Tables screen:

- Follow the screen path: Main Menu > View > Routing Tables

```
ROUTING TABLES ( Device name - FCD-IP )
--------------
1. Bridge
2. IP Interfaces
3. IP Routing
4. IPX Routing
5. IPX Services
6. ARP
7. OSPF
8. IP Address Pool
9. Inband Management

ESC - Return to previous screen
```

Figure 4-30. Routing Tables Menu

The options in the Routing Tables menu are described below.

Displaying Bridge Table

Select this option to display a table that contains information on Bridge MAC addresses (see *Figure 4-31*).

➤ To access the Bridge Table screen:

- Follow the screen path: Main Menu > View > Routing Tables > Bridge

```
 BRIDGE TABLE (Page-1) ( Device name - FCD-IP )
 ------------
 MAC ADDRESS          TYPE                  INTERFACE
 -----------          ----                  ---------
 0020D2FD5153         Static or Dynamic     LAN

 ESC - Return to previous menu
```

Figure 4-31. Bridge Table

Displaying IP Interface Table

Details the routing interfaces information.

➤ To access the IP Interfaces Table screen:

- Follow the screen path: Main Menu > View > Routing Tables > IP Interfaces

```
  IP INTERFACES TABLE (Page-1) ( Device name - FCD-IP )
  -------------------

   IP ADDRESS       IP MASK      MTU  PROTOCOL  INTERFACE  STATUS
--------------- --------------- ----- --------- ---------- ------
192.170.007.001 255.255.255.000  1500 --------- LAN 1      UP
000.000.000.000 000.000.000.000  1500 --------- LINK 1     UP

 ESC - Return to previous menu
```

Figure 4-32. IP Interfaces Table

Displaying IP Routing Table

Select this option to display a table that contains information on IP routing.

➤ To access the IP Routing Table screen:

- Follow the screen path: Main Menu > View > Routing Tables > IP Routing

```
IP ROUTE TABLE (Page-1) ( Device name - FCD-IP )

  IP ADDRESS       IP MASK      TYPE  COST     NEXT HOP     AGEING  INTERFACE
------------ --------------- ------ ---- --------------- -------- ----------
default gateway                                                     LINK 1
192.170.007.000 255.255.255.000 INTRF    0  192.170.007.001 00:00:00 LAN 1
 ESC - Return to previous menu
```

Figure 4-33. IP Routing Table

Displaying IPX Routing Table

Select this option to display information on IPX routing.

➤ To access the IPX Routing Table screen:

- Follow the screen path: Main Menu > View > Routing Tables > IPX Routing

```
IPX ROUTING TABLE (Page-1) ( Device name - FCD-IP )
-----------------
IPX NET     IPX NODE        TYPE     HOPS  TICKS   AGEING    INTERFACE
-------     --------        ----     ----  -----   ------    ---------

0000000A  0000C0F5D899  NET (RIP)     1      2   00:00:50  LAN
0000001B  0000C0F5D899  NET (RIP)     4      5   00:00:50  LAN
0000001C  0000C0F5D899  NET (RIP)     3      4   00:00:50  LAN
0000001D  0000C0F5D899  NET (RIP)     3      4   00:00:50  LAN
0000001E  0000C0F5D899  NET (RIP)     3      4   00:00:50  LAN
0000001F  0000C0F5D899  NET (RIP)     1      2   00:00:50  LAN
0000001G  0000C0F5D899  NET (RIP)     3      4   00:00:50  LAN
0000001H  0000C0F5D899  NET (RIP)     3      4   00:00:50  LAN
0000002I  0000C0F5D899  NET (RIP)     3      4   00:00:50  LAN
0000002J  0000C0F5D899  NET (RIP)     3      4   00:00:50  LAN
0000003K  0000C0F5D899  NET (RIP)     3      4   00:00:50  LAN
0000006L  0000C0F5D899  NET (RIP)     3      4   00:00:50  LAN
0000009M  0000C0F5D899  NET (RIP)     2      3   00:00:50  LAN
0000012N  0000C0F5D899  NET (RIP)     3      4   00:00:50  LAN
0000067O  0000C0F5D899  NET (RIP)     3      4   00:00:50  LAN
0000083P  0000C0F5D899  NET (RIP)     3      4   00:00:50  LAN

ESC - Return to previous menu
```

Figure 4-34. IPX Routing Table

Displaying IPX Services Table

Select this option to display a table that contains information on IPX services (SAP table).

➤ To access the IPX Services Table screen:

- Follow the screen path: Main Menu > View > Routing Tables > IPX Services

```
IPX SERVICES TABLE (Page-1) ( Device name - FCD-IP )
------------------
SERVER   NAME          TYPE      IPX NET     HOPS   INTERFACE
------------          ----      -------     ----   ---------
ACCESS                 0004     3381AFCA     2        LAN
ACCOUNT_RAD            0004     0000AAAB     2        LAN
BACKUP                 0004     0001267C     2        LAN
ENG                    0004     ACE1111D     3        LAN
EXPORT                 0004     00AA110E     2        LAN
FDD_EYE                0004     0032142F     1        LAN

ESC - Return to previous menu , N - next screen
```

Figure 4-35. IPX Services Table

Displaying ARP Table

Select this option to display the correlation between the IP address and the MAC address of each station on the LAN

➤ To access the ARP Table screen:

- Follow the screen path: Main Menu > View > Routing Tables > ARP

```
ARP TABLE (Page-1) ( Device name - FCD-IP )
---------
IP ADDRESS      MAC ADDRESS      AGING
----------      -----------      -----
192.168.1.33     0020D2FD9F16    00:00:00
192.168.1.35     0000B431CBD6    00:00:50
192.168.1.36     0000B471B335    00:02:15
192.168.1.38     0020D2FD51F0    00:02:15

ESC - Return to previous menu
```

Figure 4-36. ARP Table

Displaying OSPF Related Information

Select this option to display OSPF protocol related information such as common information, border router information, OSPF database, and interface information

➤ To access the OSPF Related Information menu:

- Follow the screen path: Main Menu > View > Routing Tables > OSPF Rel Information

```
OSPF RELATED INFORMATION  ( Device name - FCD-IP )

   1. Interfaces
   2. Neighbours
   3. Database
   4. Memory Allocation

  Press number to select or ESC to return to the previous menu:
```

Figure 4-37. OSPF Related Information Menu

➤ To access the OSPF Interfaces Table screen:

- Follow the screen path: Main Menu > View > Routing Tables > OSPF Rel Information > Interfaces

```
OSPF INTERFACES TABLE (Page-1) ( Device name - FCD-IP )
---------------------

   IP ADDRESS       AREA ID      TYPE  PRIO   DES ROUTER
-------------- -------------- ------ ---- --------------
000.000.000.000 000.000.000.001 P-T-P  0001 000.000.000.000
192.168.001.001 000.000.000.003 BRDCST 0001 192.168.001.007

   ESC - Return to previous menu
```

Figure 4-38. OSPF Interfaces Table

➤ To access the OSPF Neighbors Table screen:

- Follow the screen path: Main Menu > View > Routing Tables > OSPF Rel Information > Neighbors

```
OSPF NEIGHBOURS TABLE (Page-1) ( Device name - FCD-IP )
---------------------

   IP ADDRESS          ID       PRIO   STATE
-------------- -------------- ---- ---------
192.168.001.003 192.168.001.003 0001 Full
192.168.001.007 000.000.000.004 0001 Full

   ESC - Return to previous menu
```

Figure 4-39. OSPF Neighbors Table

➤ To access the OSPF Database Table screen:

- Follow the screen path: Main Menu > View > Routing Tables > OSPF Rel Information > Database

```
 OSPF DATABASE TABLE (Page-1) ( Device name - FCD-IP )
 -------------------

    AREA ID    TYPE       LS-ID          ORIG RTR       SEQ NUM  AGE  CKSUM
-------------- ----  --------------  --------------  -------- ----- ------
000.000.000.001   1   192.168.001.003  192.168.001.003  80000691   264  EF87
000.000.000.001   1   209.227.164.065  209.227.164.065  80000034   143  32DC
000.000.000.001   3   131.010.000.000  209.227.164.065  8000000E   154  D7C1
000.000.000.001   3   192.168.001.000  209.227.164.065  80000036   150  F9C0
000.000.000.003   1   000.000.000.004  000.000.000.004  8000010F   147  4BE2
000.000.000.003   1   209.227.164.065  209.227.164.065  80000040   160  6432
000.000.000.003   2   192.168.001.007  000.000.000.004  80000003  1423  679B
000.000.000.003   3   192.114.031.000  209.227.164.065  80000009   146  F7FD

  ESC - Return to previous menu
```

Figure 4-40. OSPF Database Table

Displaying IP Address Pool (DHCP)

Select this option to display the allocation of IP address from the IP address pool (DHCP server).

➤ To access the IP Address Pool (DHCP) Table screen:

- Follow the screen path: Main Menu > View > Routing Tables > IP Address Pools

```
IP ADDRESS POOL (Page-1) ( Device name - FCD-IP )
--------------
IP ADDRESS        IP MASK          MAC       TIME   STATUS   INTERFACE
--------------  --------------  ---------  -----  --------  ----------
001.001.001.001   255.255.255.000            0       DECLINED
001.001.001.002   255.255.255.000            0       FREE
001.001.001.003   255.255.255.000            0       FREE
001.001.001.004   255.255.255.000            0       FREE
001.001.001.005   255.255.255.000            0       FREE

ESC - Return to previous menu
```

Figure 4-41. IP Address Pool (DHCP) Table

Displaying Inband Management Routing Table

Select this option to display all routing entries learned from the Main link and Sub 1 link dedicated management timeslots.

➤ To access the Inband Management Routing Table screen:

- Follow the screen path: Main Menu > View > Routing Tables > Inband Management

```
INBAND MANAGEMENT ROUTING TABLE  ( Device name - FCD-IP )
------------------------------

 INTERFACE     IP ADDRESS     METRIC  TIME TO LIVE (MIN)
----------  ---------------  ------  -----------------
MNG LINK 1  201.201.201.201   01      0005

 ESC - Return to previous menu
```

Table 4-8. Inband Management Routing Table

Parameters	Possible Values	Description
Interface	MNG LINK 1, MNG SUB 1	Interface the routing entry was learned from; this is also the interfcae to which frames that are destined to its IP address will be forwarded
IP Address	IPv4 valid address	Learned IP address
Metric	Positive number	Reflects distance (sometimes referred to as cost) of the IP address from the device. If one address was learned from more than one interface, only the one with the lesser metric value remains
Time to Live (min)	Positive number	Each entry is removed from the table after the aging time. (This is configurable. See *Chapter 5* for more information). TTL in this table shows how many minutes are remaining before the entry is removed. 0 means the entry is about to be deleted in less than 1 minute. If an update for this entry is received before the timeout expires, its TTL is set at the maximum.

Chapter 5

Performing Advanced Setup

This chapter discusses advanced setup, which is performed using the Setup menu. Topics include:

- Host parameters setup
- Routing setup
- Interface parameters setup
- Access control (security) setup
- WAN economy setup
- Factory default options.

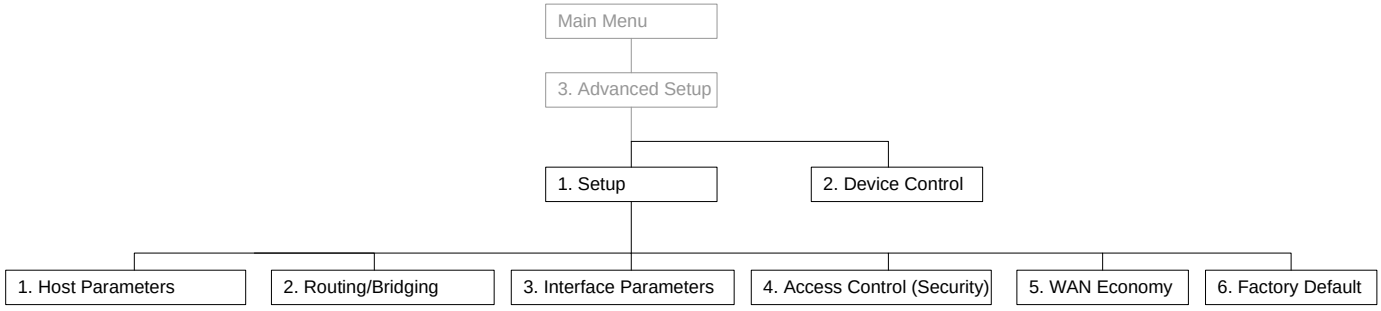


Figure 5-1. Setup Menu Outline

➤ To access the Setup menu:

- Follow the screen path: **Main Menu > Advanced Setup > Setup**

```
SETUP  ( Device name - FCD-IP )
 -----
 1. Host parameters
 2. Routing / Bridging
 3. Interface parameters
 4. Access control (Security)
 5. WAN economy
 6. Factory default options

 Press number to select or ESC to return to the previous menu:
```

Figure 5-2. Setup Menu

The options in the Setup menu are described below.

5.1 Defining Host Parameters

Select this option to enter reference information about the device, the IP Host, the SNMP agent and TFTP.

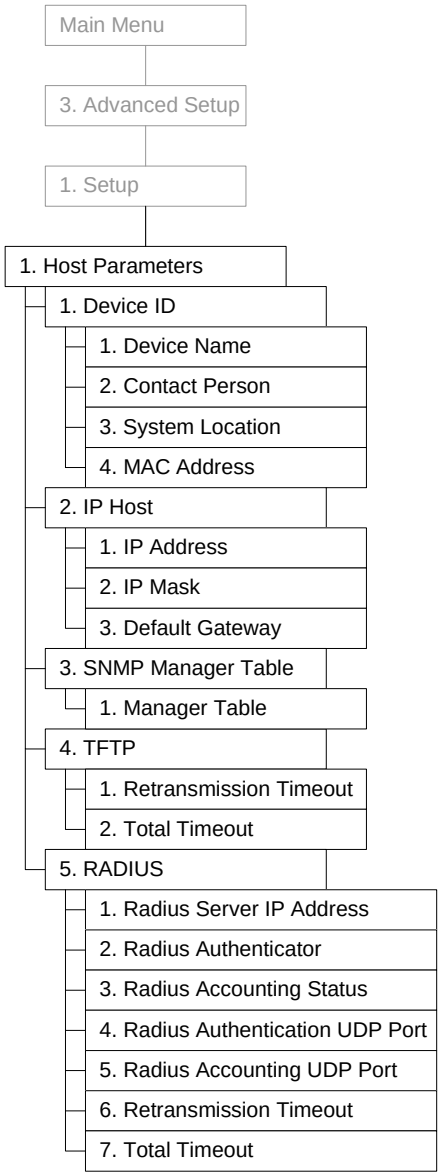


Figure 5-3. Host Parameters Menu Outline

➤ To access the Host Parameters menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Host Parameters

```
HOST PARAMETERS  ( Device name - FCD-IP )

 1. Device ID
 2. IP host
 3. SNMP manager table
 4. TFTP
 5. RADIUS

 ESC - Return to previous menu

 Choose one of the above:
```

Figure 5-4. Host Parameters Menu

The options in the Host Parameters menu are described below.

Entering Device ID

➤ To enter the Device ID menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Host Parameters > Device ID

```
DEVICE ID     ( Device name - FCD-IP )
 ---------

   1.  Device name: 27
   2.  Contact person: name of contact person
   3.  System location:
   4.  MAC address: 0020 D220 3C59 (Burned-In)

   ESC - Return to previous menu
   Choose one of the above:
```

Figure 5-5. Device ID Menu

Table 5-1. Device ID Parameters

Parameters	Description
Device Name	Assigns an arbitrary name to FCD-IP for identification by the system manager; for example "accounting"
Contact Person	Name of the person to be contacted with matters pertaining to the system; for example "John Doe"
System Location	Physical location of the device; for example "Building 3 Floor 4"
MAC Address	Assigns a MAC address locally. This allows you additional control of the devices in the LAN. FCD-IP can be used with the burned-in (default) address provided by the manufacturer or with a locally administered address; for example 4020 2D16 1234. Locally administered addresses are very useful for managing large networks

Defining IP Host Parameters

➤ To enter the IP Host Parameters menu:

- Follow the screen path: **Main Menu > Advanced Setup > Setup > Host Parameters > IP Host**

```
IP HOST  ( Device name - FCD-IP )
-------
                                CURRENT                NEW
                                -------                ---
 1.  IP address                 010.000.000.027        010.000.000.027
 2.  IP mask                    255.000.000.000        255.000.000.000
 3.  Default gateway            000.000.000.000        000.000.000.000

 ESC - Return to previous menu

 Choose one of the above:
```

Figure 5-6. IP Host Menu

Define the IP host parameters according to *Table 5-2*.

Table 5-2. IP Host Parameters

Parameters	Possible Values	Description
IP Address	Class A 1.0.0.0 to 127.255.255.255, Class B 128.0.0.0 to 191.255.255.255, Class C 192.0.0.0 to 223.255.255.255, Class D 224.0.0.0 to 239.255.255.255, Class E 240.0.0.0 to 247.255.255.255	Every device on a TCP/IP network must have an address for identification. The IP address is a value consisting of the network address and the host address on that network. The value assigned to a network depends on the number of computers on that network. The IP address is a 32-bit number. The number is made up of 4 parts, with each part consisting of 3 digits. One part of the address identifies the network and another part of the address identifies the host. The numbers in the address, which identify the host, are dependent on the class. There are 5 classes of IP addresses. Each class represents a network having a certain number of computers. For example, a Class C address is given to a network having between 1 to 255 computers. The numbers in each part of the code are translated into binary code, which identifies the network and the host. IP addresses are assigned by the Internet Network Information Center (InterNIC). InterNIC assigns the network ID. Host IDs are assigned by the network administrator.
IP Mask	Default IP mask for Class A 255.0.0.0 Default IP mask for Class B 255.255.0.0 Default IP mask for Class C 255.255.255.0 Default IP mask for Class D 255.255.255.225	A subnet is a portion of a network that shares a common address component. On TCP/IP networks, subnets are defined as all devices whose IP addresses have the same prefix. For example, all devices whose IP addresses begin with 133.100.100. are part of the same subnet. An IP mask allows you to filter IP addresses on a subnet. When an IP address is configured, the IP mask is automatically configured according to the Class of the IP Network. ***Note**: The default IP mask can be edited.*
Default Gateway		The default gateway defines where frames will be sent, if no explicit routing is defined in the routing table. The default gateway can be an IP address or a WAN interface. If you choose to use an IP address, enter the address of the router that will deliver the frames. Specifying an IP address for the default gateway is done with shared media, such as LAN interface. If you choose to use a WAN interface, the connection to the router is point-to-point. Choose by interface and enter the interface/DLCI number.

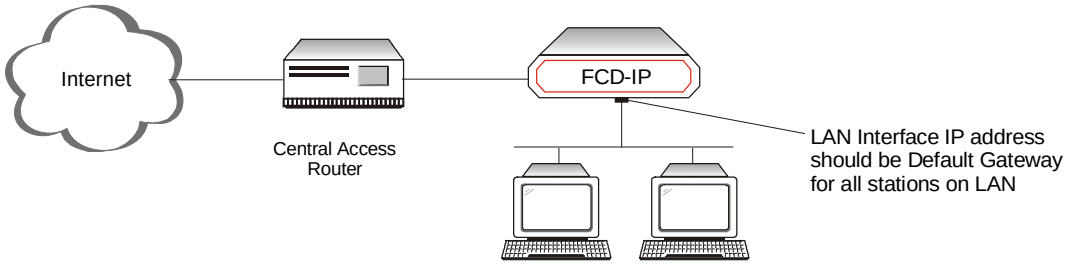


Figure 5-7. Default Gateway

Note *It is very important to obtain the correct parameters from the system administrator or ISP. The most common problem when establishing an IP connection is incorrect configuration of the IP parameters and default gateway. Do not try to guess these parameters.*

Defining SNMP Managers

➤ To enter the SNMP Manager Table Menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Host Parameters > SNMP Manager Table

```
       MANAGER TABLE SETTING  ( Device name - FCD-IP )
       ---------------------
        IP address      Mask

  1. 010.000.000.222    Yes


OPTIONS: C-Clear all, E-Edit, D-Delete, A-Add

Press one of the above or ESC to return to previous screen:
```

Figure 5-8. SNMP Manager Table Menu

Select this option to add, clear or delete parameters from the manager table. The manager table lists the SNMP manager IP addresses and masks. Simple Network Management Protocol (SNMP) manager IP address is the IP of the management station, which the traps are sent to (NMS). To send traps to that NMS, set the mask parameter to YES.
SNMP is an application-layer protocol designed to facilitate the exchange of management information between network devices. By using SNMP to access management information data (such as packets per second and network error rates), network administrators can more easily manage network performance and find and solve network problems.

Configuring TFTP Parameters

➤ To enter the TFTP menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Host Parameters > TFTP

```
TFTP  ( Device name - FCD-IP )

 1. Retransmission timeout (seconds): 15
 2. Total timeout (seconds)         : 60

Press the number to edit value or ESC to return to the
previous screen:
```

Figure 5-9. TFTP Menu

TFTP is a simple file transfer protocol running over IP that permits unsecured and unauthorized file exchange over the Internet/Intranet. TFTP is widely used to upgrade software and configuration parameters for various standalone units. TFTP is a client-server type protocol; FCD-IP operates as the TFTP client. In order to use the TFTP-based features of FCD-IP you need TFTP server software running on some of your PCs.
This screen permits you to configure common TFTP session parameters that are used for software upgrades and upload/download features.

Table 5-3. TFTP Parameters

Parameters	Possible Values	Description
Retransmission Timeout	For example: 30 seconds	The amount of time that is allowed to pass before the last non-acknowledged request is transmitted.
Total Timeout	For example: 60 seconds.	The amount of time FCD-IP should wait for an acknowledgment from the TFTP server in case a frame is lost, or there are other problems.

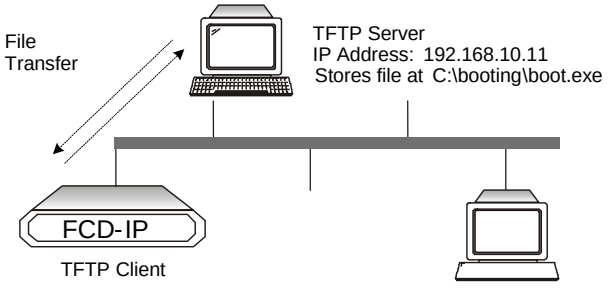


Figure 5-10. File Transfer to and from TFTP Server

Configuring RADIUS (Authentication and Billing)

➤ To enter the RADIUS menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Host Parameters > RADIUS

```
      RADIUS  ( Device name - FCD-IP )

  1. Radius server IP Address        :
  2. Radius authenticator            :
  3. Radius accounting status        : [Disable]
  4. Radius authentication UDP port  : 1812
  5. Radius accounting UDP port      : 1813
  6. Retransmission timeout (seconds): 15
  7. Total timeout (seconds)         : 60

 Press the number to edit value or ESC to return to the previous screen:
```

Figure 5-11. RADIUS Menu

The RADIUS (Remote Authentication Dial-In User Service) is a client/server security protocol. Security information is stored in a central location, known as the RADIUS server. RADIUS clients, such as FCD-IP, communicate with the RADIUS server to authenticate users. Although the term RADIUS refers to the network protocol that the client and server use to communicate, it is often used to refer to the entire client/server system.

The three main functions of RADIUS are:

- Authentication
- Authorization
- Accounting.

To perform these functions, you must configure the parameters described in *Table 5-4*.

Table 5-4. RADIUS Menu Parameters

Parameters	Possible Values	Description
RADIUS Server IP Address		The IP address of the RADIUS server, for example 192.168.1.9.
RADIUS Authenticator		Enter the shared secret. The *shared secret* is a password used by RADIUS to authenticate the client. It is important to remember that the client is FCD-IP. Do not supply the shared secret. ***Note**: When configuring the RADIUS Authenticator, be sure to use the same value in the RADIUS server and FCD-IP.*
RADIUS Accounting Status	Enable Disable	Track link up/link down activity. This information is often used for billing purposes.

Parameters	Possible Values	Description
RADIUS Authentication Port		Selects the UDP port number to be used for the RADIUS authentication application. Confirm that the same value is defined in the RADIUS server
RADIUS Accounting Port		Selects the UDP port number to be used by the RADIUS accounting application. Confirm that the same value is defined in the RADIUS server
Retransmission Timeout		The maximum time FCD-IP waits for a single request response from the RADIUS server, for example 30 seconds. After this time the request will be retransmitted.
Total Timeout		The total time FCD-IP tries to communicate with the RADIUS server

5.2 Configuring Routing/Bridging

Select this option to enter FCD-IP routing information.

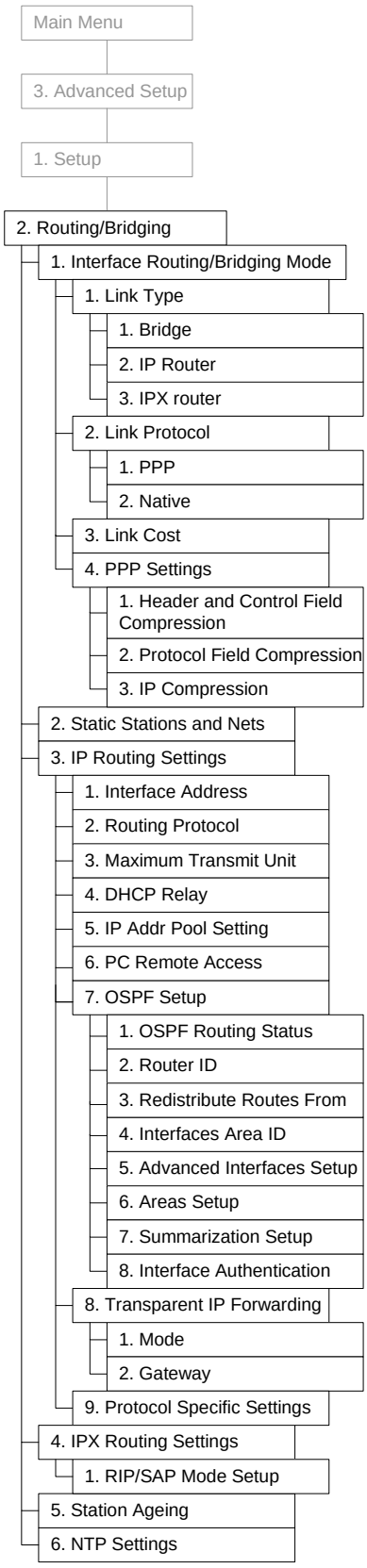


Figure 5-12. Routing Menu Outline

➤ To access the Routing/Bridging menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging

```
   ROUTING/BRIDGING ( Device name - FCD-IP )

   Link 1 - IP & IPX ROUTER  PPP

   Setup Menu
 1. Interface Routing/Bridging Mode
 2. Static stations & nets
 3. IP routing settings
 4. IPX routing settings
 5. Station aging (minutes): 60
 6. NTP settings

  ESC - Return to previous menu

  Choose one of the above:
```

Figure 5-13. Routing/Bridging menu

The options in the Routing/Bridging menu are described below.

Selecting Interface Routing/Bridging Mode

Note *When there is more than one link in the device, you are prompted for link number.*

➤ To access the Interface Routing Bridging Mode menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging > Interface Routing/Bridging Mode

```
     ROUTING MODE: LINK 1 ( Device name - FCD-IP )

 1. Link type        - IP Router
 2. Link protocol    - PPP
 3. Link cost/metric - 1
 4. PPP settings

  ESC - Return to previous menu

  Choose one of the above:
```

Figure 5-14. Interface Routing Bridging Mode Menu

To perform these functions, configure the parameters in *Table 5-5*.

Table 5-5. Interface Routing/Bridging Mode Menu Parameters

Parameters	Possible Values	Description
Link/LAN Type	1. Bridge 2. IP Router 3. IPX Router Any combination of these types	Assigns the link/LAN type, for each interface. Use <1>, <2>, <3> to enable/disable each option.
Link Protocol (not available when link is in Frame Relay mode)	Protocols For Synchronous Links: PPP Native Protocols For Asynchronous Links: PPP SLIP CSLIP Terminals Server	Defines the type of encapsulation while sending frames through the WAN interface. The settings are different for various link types. The FCD-IP Terminal Server option listens to port 10001 in order to open a TCP connection. It is not possible to have a Telnet and a Terminal Server connection simultaneously. ***Note:*** *When the Native protocol is used with a Router, protocol packets pass in HDLC format.* *When the Native protocol is used with a Bridge, MAC frames pass in HDLC format.* *When using Terminal Server mode, the modem mode must be set to direct connection. This mode is available only for asynchronous links of type V.24 DTE.*
Link Cost/Metric		Assigns a cost to each WAN link for routing purposes. This parameter affects FCD-IP's operation of the corresponding interface configured to use RIP routing protocol. Each routing entry is accompanied by a metric, which is the number of routers through which a packet must go to get to its destination. Before updating routing tables, FCD-IP adds link cost value to all routing metrics received from this link; this may affect further routing decisions. A router will automatically send packets using the lowest possible metric. If a router is not functioning, FCD-IP will send the packets through an interface with a higher metric.

Defining PPP Settings

This option is only available for PPP link protocol.

Table 5-6. PPP Settings

Parameters	Possible Values	Description
Header and Control Field Compression	Yes, No	Used for troubleshooting only. Change the Header and Control Field Compression setting only if there is a problem with PPP negotiation
Protocol Field Compression	Yes, No	Used for troubleshooting only. Change the Protocol Field Compression setting only if there is a problem with PPP negotiation
IP Compression	Yes, No	Activates Van Jacobson TCP Header Compression on a specified link. PPP is often used on slow bandwidth links, such as modems. To make the transmission faster, certain parts of the data packets can be compressed. In Van Jacobson TCP Header Compression the TCP/IP packet header is compressed according to RRC 1144. Other protocols running over IP (for example, UDP, ICMP) are not affected by using Van Jacobson compression. Since PPP is used for point to point transmissions, both the local and remote devices must have Van Jacobson TCP Header Compression enabled for compression to be performed. To verify that Van Jacobson TCP Header Compression is being performed, open the Interface Connections Screen
Multilink (not available when there is only one link)	Disabled Permanent BOD	Determines if a line supports multilink PPP (RFC 1990 compliant). The line does not support multilink PPP (changing from Disabled to Permanent causes the device to be reset) The line supports multilink PPP The line enables multilink PPP with Bandwidth-on-Demand support (for ISDN line only). Permitting multilink PPP means that two neighboring links (or two ISDN B-channels) will work as a single logical channel, thereby increasing the total link bandwidth. If you select *Permanent*, then both links will be connected simultaneously, independent of bandwidth utilization. Using *BOD* permits you to be connected most of the time with only one B-channel and to be connected with the second channel for small periods of high bandwidth utilization. This method reduces connection costs. If you choose BOD, then configure the following parameters: Sensibility Direction and Sensibility Timeout.
BOD Sensibility Direction	Transmit, Receive, Both	Defines the traffic direction to be counted in determining whether to connect the second line.
BOD Sensibility Timeout		Defines the time interval for the utilization count

Defining Static Stations and Nets

➤ To define Static Stations and Nets:

- Follow the screen path: **Main Menu > Advanced Setup > Setup > Routing/Bridging > Static Stations and Nets**

```
STATIC STATIONS AND NETS(MAC, IP, IPX) ( Device name - FCD-IP )

1. IP - 192.168.182.056 mask-255.255.255.248 interface-2/16   cost-1
2. IPX - 25490880       interface-3      cost-1

A - Add , C - Clear all , D - Delete
ESC - Return to previous menu.
```

Figure 5-15. Adding Static Stations and Nets

Select this parameter to add, delete, or clear static entries in the IP/IPX Routing table or Bridge Routing table. If FCD-IP is attached to more than one LAN, then select this parameter for each LAN interface, if necessary. The Aging Mechanism does not remove static entries from the routing tables.

Note *The maximum number of static routes to IP stations or networks plus IP interfaces is 64.*

When adding static entries in the IP/IPX Routing table or Bridge Routing table, they can be defined in 4 ways (see *Table 5-7*).

Table 5-7. Static Stations and Nets

Parameters	Description
MAC	MAC Station defines a single static entry in the Bridge routing table. The entry is a single MAC Address (6 bytes) entered in hexadecimal format.
IP Net	IP Net defines a network as the destination. IP Net consists of 3 parts: **Destination** – defined by entering the subnet IP address and IP mask. For example, 192.168.182.32 is a subnet IP address and 255.255.255.240 is the IP mask. **Frame pathway** – specified either as an interface (i.e. port) number or as Next Hop IP address. In Next Hop IP the frames are sent to another router; from there they will be sent to their final destination (see *Figure 5-16*). **Cost** – used only for advertising via routing protocols. The values are 1 to 15.
IP Station	Defines a single host as the destination. IP Station consists of 3 parts: **Destination** - defined by entering the host IP address; for example, 192.168.182.11 **Frame pathway** - specified as in IP Net, above. **Cost** – used only for advertising via routing protocols. The values are 1 to 15.
IPX Net	Used for IPX routing. Defines the IPX Net in hexadecimal and the interface number. **Cost** – used only for advertising via routing protocols. The values are 1 to 15.

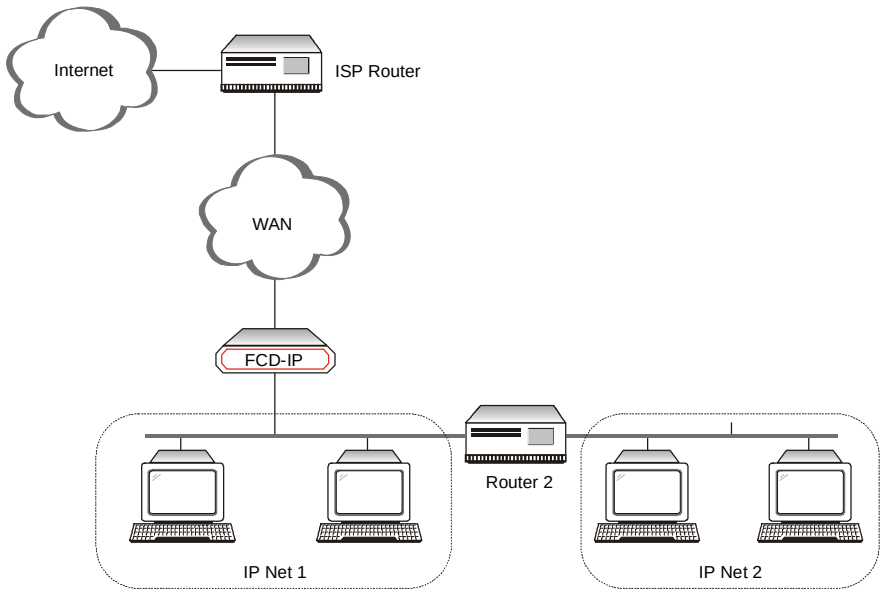


Figure 5-16. Router 2 set to "Next Hop" in FCD-IP

Setting IP Routing

➤ To access the IP Routing Settings menu:

- Follow the screen path: **Main Menu › Advanced Setup › Setup › Routing/Bridging › IP Routing Settings**

```
IP ROUTING SETTINGS ( Device name - FCD-IP )

 1. Interface address
 2. Routing Protocol
 3. Maximum transmit unit
 4. DHCP relay
 5. IP address pool setting
 6. PC remote access
 7. OSPF Setup
 8. Transparent IP forwarding
 9. Protocol Specific Settings

 ESC - Return to previous menu
 Choose one of the above:
```

Figure 5-17. IP Routing Settings Menu

Defining Interface Address

Select this parameter to enter an IP address for each WAN interface and one or more IP addresses for the LAN interface. Multiple IP addresses on the LAN are useful in environments with multiple IP nets on the LAN (refer to *Figure 5-18*). If your FCD-IP setup has two LAN interfaces use this screen to enter one or more IP addresses for the second LAN.

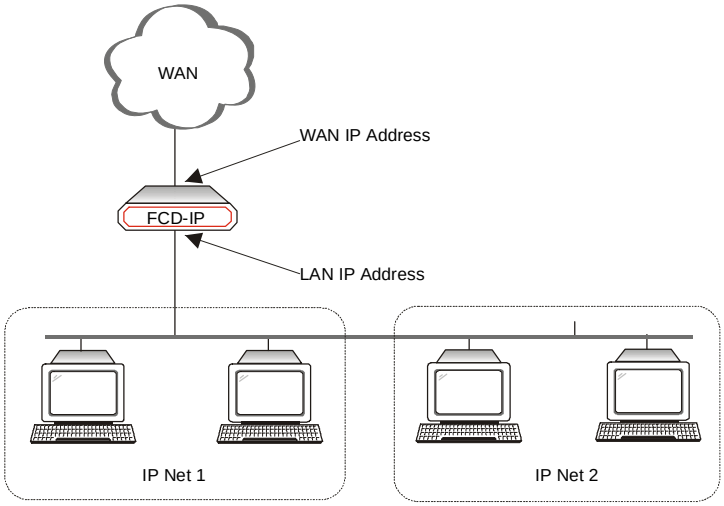


Figure 5-18. WAN and LAN Interface Addresses

Selecting Routing Protocol

This parameter sets the type of routing advertisement protocol to be used for each FCD-IP interface (LANs and WANs).

If FCD-IP is configured as a RIP or OSPF router, it sends/receives information from its routing table to/from corresponding router(s), learning its environment dynamically.

Table 5-8. Routing Protocol Settings

Values	Description
RIP1	Sends and receives routing information about IP nets only
RIP2	Sends and receives full routing information, including subnets
RIP1+2	Sends information as for RIP2 (full routing information, including subnets), and receive both RIP1 and RIP2 (routing information about IP nets only)
OSPF	Uses Open Shortest Path First protocol
None	FCD-IP will not negotiate routing information with neighboring routers

Setting Maximum Transmit Unit

This parameter sets the maximum transmit unit (MTU) for IP fragmentation. Set the MTU for each interface (LANs and WANs). If a frame is larger than the MTU, it

will be fragmented into smaller units, while it is sent through the specified interface.

FCD-IP has no lower limit for the MTU value. However, IP fragments (except the last) must be at least eight bytes in size. Therefore, the minimum frame size (except for the last fragment, which could be anywhere above 20 bytes) is 28 bytes, even if less than 28 is configured as the MTU. (28 bytes includes the IP header size plus the minimum IP fragment size).

OSPF Considerations

- For OSPF-enabled links, both sides must be configured with the same MTU value.
- It is recommended, for OSPF links, not to fragment OSPF data updates, but rather break the information into a few updates. FCD-IP needs roughly 120 bytes to send a minimal update. With two links, this number may be higher.

The bottom line is, do not configure an MTU value less than 120 bytes on OSPF links. You will not be warned, but OSPF data may not render correctly. Also note that in case of large networks that may require large updates, a small MTU value will cause a lot of overhead traffic because of the multiple OSPF frames and headers.

Configuring DHCP Relay

This parameter enables transmission of DHCP requests to specified IP addresses via WAN and LAN links.

Defining IP Address Pool Setting (DHCP)

This parameter determines the option for how FCD-IP assigns IP addresses dynamically to connected workstations. FCD-IP uses one of the following mechanisms to assign IP addresses dynamically to workstations:

Table 5-9. IP Address Pool Setting (DHCP)

Values	Description
IPCP Negotiations	This is a mechanism where the remote router or a workstation connected to FCD-IP via a link requests an IP address. This request is made by specifying zero for the IP address in the IPCP configure request (PPP).
DHCP	This protocol is an extension to BOOTP and permits FCD-IP to supply not only an IP address but also additional parameters, such as Default Gateway, DNS server addresses etc. FCD-IP supplies these parameters to the client's workstation. In contrast to BOOTP, DHCP supplies these parameters on a temporary basis. FCD-IP using DHCP checks on the workstation periodically. If the workstation is not using the IP address, the IP address can be supplied to other workstations later.

FCD-IP supports all these mechanisms simultaneously.

Defining IP Address Pool

Select this option to define IP address information.

➤ To access the IP Address Pool screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging > IP Routing Settings > IP Address Pool Setting

```
IP ADDRESS POOL ( Device name FCD-IP )
---------------
Pool of IP addresses dynamically allocated by the device working as Remote
Access server or DHCP server to workstations over the WAN/LAN.
Allocation can be made via DHCP and PPP-IPCP request.

 1. IP Address 001.001.001.001 – 001.001.001.005  Mask: 255.255.255.000
    Default gateway: 001.001.001.001
    Primary DNS: 194.090.001.005, Secondary DNS: 000.000.000.000
    Protocol: DHCP



 OPTIONS: C-Clear all, E-Edit, D-Delete, A-Add
 Press one of the above or ESC to return to previous screen:
```

Figure 5-19. IP Address Pool Menu

You can define up to five entries. Each entry contains the parameters shown in *Table 5-10*.

Table 5-10. IP Address Pool Settings

Parameters	Description
Low IP Address	Lower boundary of the IP address range
High IP Address	Upper boundary of the IP address range
IP Mask	IP mask for the IP address range (for DHCP and BOOTP)
Default Gateway	Default Gateway IP address for workstations which receive IP addresses from the range defined by the Low IP Address and High IP Address. The Default Gateway IP address must be within this IP address range (used by DHCP only).
Primary DNS	IP address of the DNS server, which can be used by the workstation (for DHCP and IPCP).
Secondary DNS	Additional DNS server address that is an alternative to the Primary DNS (for DHCP and IPCP).
Protocol	Specifies the protocol type: DHCP or IPCP

Note

There is no need to specify an interface for each pool of IP addresses. FCD-IP recognizes if the request came directly from a DHCP client connected to one of its interfaces or via a DHCP relay and allocates an address out of the suitable IP address pool according to the request origin.

Configuring PC Remote Access

Select this parameter to define the remote access. The PC Remote Access Option is important if FCD-IP is used as a remote access server for remote PCs accessing the LAN. Refer to *Figure 5-20*.

➤ To access the PC Remote Access screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging > IP Routing Settings > PC Remote Access

```
PC Remote Access ( Device name - FCD-IP )

 1. Shared IP net - 192.168.1.1    mask - 255.255.255.240

 ESC - Return to previous menu
 Choose one of the above:
```

Figure 5-20. PC Remote Access

Defining Shared IP Net Address

Select this parameter to enter the Shared IP net address. The Shared IP net address is used by all remote workstations that connect to the remote access server on the WAN links.

Configuring OSPF Settings

Select this option to configure the parameters for the Open Shortest Path First (OSPF) protocol. The OSPF Protocol is a dynamic routing protocol that detects topological changes in the AS and calculates new loop-free routes after a short period of convergence with minimal routing traffic.

Note *Configure at least one of the IP router interfaces for OSPF routing protocol. This is performed from the* ***Routing Protocol*** *menu.*

➤ To access the OSPF Settings menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging > IP Routing Settings > OSPF Setup

```
OSPF SETTINGS ( Device name - FCD-IP )

   1.  OSPF routing status         [Enable ]
   2.  Router ID                 : 209.227.164.065
   3.  Redistribute routes from    [Static only ]
   4.  Interfaces area ID
   5.  Advanced interfaces setup
   6.  Areas setup
   7.  Summarization setup
   8.  Interface authorization

  Choose one of the above or press ESC to return to previous
menu :
```

Figure 5-21. OSPF Settings Menu

Note *Changing any of the parameters in this screen causes the device to be reset (after exiting and saving). It is recommended to configure all the parameters before leaving this screen, to avoid multiple resets.*

Table 5-11. OSPF Settings

Parameters	Possible Values	Description
OSPF routing status	Enable Disable	Enables or disables the OSPF option
Router ID		Configure router ID. According to RFC 2328 it is often set to be equal to the smallest IP address of router interfaces. We require configuring it explicitly, because changing its value must restart OSPF software. The better way is to change it together with enabling OSPF
Redistribute routes from	Nothing Static Only RIP Only Static & RIP	
Interfaces area ID		Configures the area ID for OSPF interfaces. Area IDs in FCD-IP are formatted as IP addresses. Each OSPF link can be assigned one area ID. If an area ID was not assigned, the default area 0.0.0.0 (that is, area 0) is used by the router.

Defining the Interface Area ID

➤ To access the Interfaces Area ID menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging > IP Routing Settings > OSPF Setup > Interfaces Area ID

```
INTERFACES AREA ID  ( Device name - FCD-IP )

  1. LINK 1/CH1  Area ID: 001.001.001.001
  2. LINK 1/CH2  Area ID:
  3. LINK 2      Area ID: 002.002.002.002
  4. LAN 1       Area ID: 000.000.000.001


 Press the number to edit value or ESC to return to the previous screen:
```

Figure 5-22. Interfaces Area ID

Performing Advanced Interfaces Setup

Parameters described in this section are used for fine-tuning of OSPF interfaces configuration, as described in RFC 2328.

➤ To access the Advanced Interfaces Setup screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging > IP Routing Settings > OSPF Setup > Advanced Interfaces Setup

```
OSPF ADVANCED INTERFACES SETUP ( Device name - FCD-IP )
------------------------------
     Interface     Prty  Hello int.  Dead int.  Metric
  1.  LAN1            3       30        50        2


OPTIONS: A-Add

Press one of the above or ESC to return to previous screen:
```

Figure 5-23. Advanced Interfaces Setup Screen

Setting up Areas

This group defines parameters that may be different for different areas.

➤ To access the OSPF Areas Setup screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging > IP Routing Settings > OSPF Setup > Areas Setup

```
OSPF AREAS SETUP ( Device name - FCD-IP )
---------------
  Area   Type               Authentication

  1.      000.000.000.000   Normal   Normal



OPTIONS: C-Clear all, E-Edit, D-Delete, A-Add

Press one of the above or ESC to return to previous screen:
```

Figure 5-24. OSPF Areas Setup

Table 5-12. OSPF Areas Setup

Parameters	Possible Values	Description
Area	0.0.0.0. to 255.255.255.255	
Type	Normal	Accepts all types of OSPF traffic (Standard Area)
	Stub	Accepts all types of OSPF traffic, except AS-external-LSAs (type 5 LSAs)
	NSSA	Not-So-Stubby-Area – a stub area that connects to an external AS
Authentication	Normal	Normal – not authenticated
	MD-5	MD-5 – encrypted authorization method
	Simple	Simple – not presently implementd

Setting up Areas OSPF Summaries

To reduce the number of LSAs advertised, it is common practice in OSPF to configure IP subnets in contiguous manner and to define subnet summarization. It means that the area border router will try to aggregate various subnets it learned in one area before advertising it in another area.

➤ To access the OSPF Summaries Setup screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging > IP Routing Settings > OSPF Setup > Summarization Setup

```
OSPF SUMMARIES SETUP ( Device name - FCD-IP )
--------------------
          Area              Ip               Mask         Advert.

  1.  010.001.036.000  010.001.037.000  255.255.255.000    Yes
  2.  010.001.036.000  010.002.037.000  255.255.255.000    Yes


OPTIONS: C-Clear all, E-Edit, D-Delete, A-Add

Press one of the above or ESC to return to previous screen:
```

Figure 5-25. OSPF Summaries Setup

Setting up Interface Authorization

➤ To access the OSPF Interface Authorization Setup screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging > IP Routing Settings > OSPF Setup > Interface Authorization

```
       OSPF INTERFACE CRYPTOGRAPHY SETUP ( Device name - FCD-IP )
       --------------------------------
       Interface     Key ID    Key String

  1.   LINK 1            1
  2.   LINK 2            1
  3.   LAN 1 100M        1

OPTIONS: C-Clear all, E-Edit, D-Delete, A-Add

Press one of the above or ESC to return to previous screen:
```

Figure 5-26. OSPF Interface Authentication Setup

Note *Interface authorization takes priority over area authorization.*

OSPF messages can be authenticated with MD5. A user can configure either area or interface MD5 authentication. When configuring area authentication, the user must configure all OSPF devices in the same area with the same authentication method. When configuring interface MD5 authentication, all devices that receive and send messages directly on that interface must be configured with MD5 (and with the same authentication keys). If both area and interface MD5 authentication are configured, interface authentication parameters take precedence.

Configuring Transparent IP Forwarding

➤ To access the IP Transparent Setup screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging > IP Routing Settings > Transparent IP Forwarding

```
       IP TRANSPARENT SETUP     ( Device name - FCD-IP    )

   1.  Mode:      [Disable]
   2.  Gateway:



Press one of the above or ESC to return to previous screen:
```

Figure 5-27. IP Transparent Setup

Configuring Routing Protocol Settings

➤ To access the IP Routing Protocols Specific Settings screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging > IP Routing Settings > Protocols Specific Settings

```
       IP ROUTING PROTOCOLS SPECIFIC SETTINGS ( Device name - FCD-IP    )

   1.  Send RIP2 in Multicast      [Disable]

Press one of the above or ESC to return to previous screen:
```

Figure 5-28. IP Routing Protocols Specific Settings

The default setting (disable) sends the RIP2 protocol in broadcast mode.

When RIP2 multicast is enabled, FCD IP uses MAC address 01 00 5E 00 00 09 to send RIP2 messages.

Configuring IPX Routing

➤ To access the IPX Routing Settings screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging > IPX Routing Settings

```
IPX ROUTING SETTINGS ( Device name - FCD-IP )
--------------------
1. LAN IPX net for frame type 802.3        - 00000000
2. LAN IPX net for frame type Ethernet II  - 00000000
3. LAN IPX net for frame type 802.2        - 00000000
4. LAN IPX net for frame type SNAP         - 00000000
5. Dial-in IPX net                         - D2162747
6. Autolearn of zero LAN IPX nets          - [Enable]
7. RIP/SAP mode
ESC - Return to previous menu
Choose one of the above:
```

Figure 5-29. IPX Routing Settings

Select this parameter to specify parameters required for operating FCD-IP as an IPX router.

Table 5-13. IPX Routing Settings

Parameters	Possible Values	Description
LAN IPX Net for Frame Type		Each of these parameters specifies the IPX Nets associated with a particular frame type. If FCD-IP is in Autolearn enable mode, then non-zero values point to learned Net. FCD-IP supplies default values for these frame types that can be configured on PC's operating on LANs without other IPX routing.
Dial-in IPX Net		Specifies the IPX Net definition for a WAN interface
Autolearn Zero LAN IPX Nets	Enable Disable	By setting this parameter to Enable, FCD-IP learns IPX Nets from RIP/SAP frames sent by other IPX routers on the same LAN. Refer to *Figure 5-30*. If there are no other IPX routers on FCD-IP LAN, this parameter must be set to Disable, and you must configure the IPX Nets for each frame type.

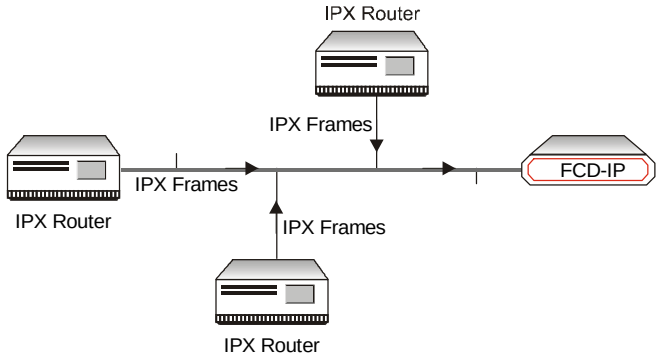


Figure 5-30. Automatic Learning from IPX Frames

Configuring RIP/SAP Mode

➤ To access the RIP/SAP Mode Setup screen:

- Follow the screen path: **Main Menu › Advanced Setup › Setup › Routing/Bridging › IPX Routing Settings › RIP/SAP Mode Setup**

```
RIP / SAP MODE SETUP ( Device name - FCD-IP )

 1. Link 1 RIP/SAP mode: [Enabled]
 2. LAN    RIP/SAP mode: [Enabled]

 ESC - Return to previous menu
 Choose one of the above:
```

Figure 5-31. RIP/SAP Mode Setup

Selecting Link 1 RIP/SAP Mode

Select this parameter to **Enable/Disable** the RIP/SAP mode. The default setting enables sending RIP and SAP tables for all updates and interfaces (Link and LAN).

When disabled FCD-IP does not send RIP/SAP frames, but receives and processes RIP/SAP frames sent from other routers.

Configuring Station Ageing

➤ To access the Station Aging menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging > Station Aging

```
        AGEING  ( Device name - FCD-IP )
        ------

  Enter ageing time for stations learned by Remote
  Access Server.

  ESC - Return to previous menu
  Current station ageing     (minutes): 60
  New stations ageing (1- 255 minutes):
```

Figure 5-32. Station Aging Menu

Configuring NTP Settings

➤ To access the NTP Settings menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Routing/Bridging > NTP Settings

```
     NTP SETTINGS ( Device name - FCD-IP    )

  1.  NTP request frequency in seconds (0 : NTP disabled ) :[0]
  2.  NTP Server ID (0: no server )                        :[000.000.000.000]
  3.  NTP timeout  (0 : no timeout )                       :[0]
  4.  NTP via Inband Mng. Links                            :[Disable]
  5.  NTP UTC Offset (GMT+x)                               :[0]
  6.  Daylight saving time starts (+1 hour)                :[00/00]
  7.  Daylight saving time ends                            :[00/00]
```

Figure 5-33. NTP Settings Menu

Table 5-14. NTP Settings

Parameters	Possible Values	Description
NTP request frequency in seconds		
NTP Server ID		IP address of the NTP server
NTP timeout		NTP timeout (in seconds) means that if the device hasn't received an update from the server by this time, it zeros its clock.
NTP via Inband Mng. Links	Disable Enable	Disable – NTP packets are sent and received using the normal routing table Enable – NTP packets are sent and received using the inband management link
NTP UTC Offset		In hours
Daylight saving time starts		DD/MM format
Daylight saving time ends		DD/MM format

5.3 Configuring the Interfaces

Select this option to set general parameters and link, Frame Relay, ISDN or E1/T1 parameters.

The Interface Parameters menu is dynamic, depending on the hardware configuration. Only those screens / parameters that are applicable to your interface will appear.

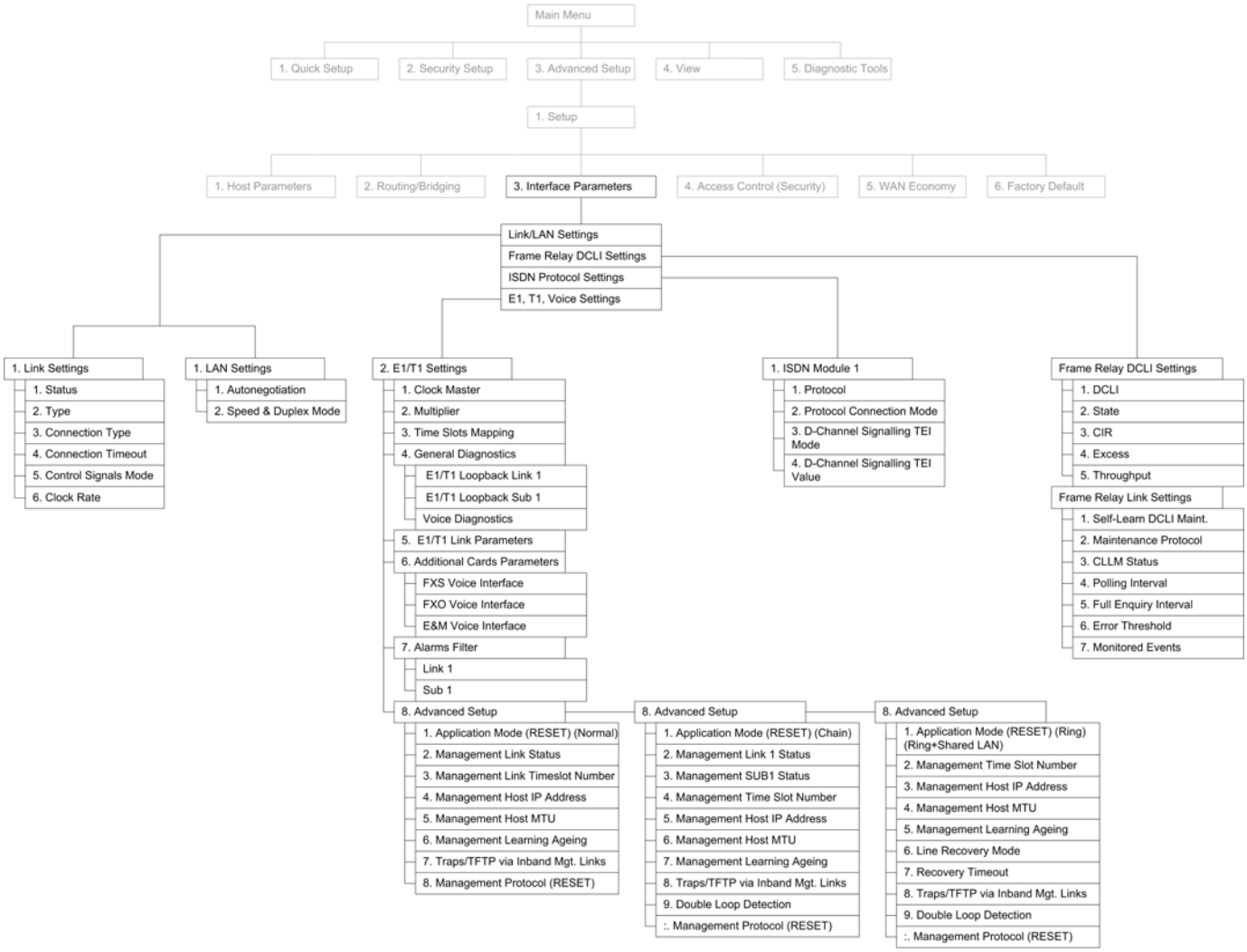


Figure 5-34. Interface Parameters Menu Outline

➤ To access the Interface Parameters menu:

- Follow the screen path: **Main Menu > Advanced Setup > Setup > Interface Parameters**

```
INTERFACE PARAMETERS ( Device name - FCD-IP )

1.  Link/LAN settings
2.  E1, T1, voice settings
3.  ISDN settings
4.  Frame relay settings

ESC - return to previous menu
Choose one of the above:
```

Figure 5-35. Interface Parameters

Note *Link/LAN settings option is displayed only for the units with a single 10/100BaseT port. It is not available for the units with 10BaseT port or 4-port switch.*

The options in the Interface Parameters menu are described below.

5.4 Configuring Link Parameters

➤ To access the Link Settings menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Interface Parameters > Link/LAN Settings

```
      LINK SETTINGS  ( Device name - FCD-IP )

  1. Status
  2. Type
  3. Connection Type
  4. Connection Timeout (sec)
  5. Control Signals Mode
  6. Clock Rate
 Press number to select or ESC to return to the previous menu:
```

Figure 5-36. Link Settings Menu

The Link Settings Menu lists parameters that are specific to the line hardware. The Menu is dynamic, depending on which hardware interface and protocol you have ordered.

The parameters that follow apply to all link types.

Table 5-15. Link Settings

Parameters	Possible Values	Description
Status	Enabled	Transmits frames. Normally you want all links in enabled status
	Disabled	Does not transmit frames. The link may be permanently disabled, for example, when testing. A disabled line freezes all link operation, including connection attempts and forwarding.
	Backup	If a link is defined as backup to another, then whenever the main link operates normally, the backup link is *disabled*. If the main link fails, the backup link begins to operate and become *enabled*. You must verify that the routing settings are correct so that traffic will be forwarded to the desired destination via the backup link. When you restore the main link connection, the backup link becomes *disabled* again. ***Note:*** *The device must have two links in order to use the backup feature.*
Type	Synchronous	Data bits are transmitted at a fixed rate, because the sender and the receiver are synchronized
	Asynchronous (only applicable to V.xx DTE links)	Units of data are sent one character at a time. Characters are preceded by start bits and followed by stop bits, which provide synchronization at the receive terminal.
	Frame Relay	A packet-switching protocol for connecting devices on a WAN.

Parameters	Possible Values	Description
Connection Type	Originate only Answer only Answer & Originate	If the link is to be used to connect to the Internet or intranet If the link is to be used for receiving remote access connection If the link is to be used for both incoming and out going connections (not simultaneously) ***Note**: This parameter only affects dial-up link types (asynchronous with modem or ISDN). For leased-line links, select Answer-only.*
Connection Timeout (sec)		Specifies the connection timeout. The remote side has to answer within the time allotted with the connection timeout. If within this time there is no response, you are informed that the remote side is no longer active. This is meaningful only if the link is configured for PPP protocol. ***Note**: Connection timeout is only configured when the PPP protocol is used.*
Control Signals Mode	ON, Ignore	Determines whether the control signals are ignored or acknowledged by link hardware
Baud Rate		Specifies the rate at which data is sent across the link ***Note**: For asynchronous links only.*
Parity	Odd Even None	Specifies the parity. Parity is a method of checking for errors. A parity bit is a non-information bit that is added to a group of bits to ensure that the total number of bits in a character is odd or even. If you know that the total number of bits must be odd any group of bits whose total number is even must be erroneous. ***Note**: For asynchronous links only.*
Stop Bit	1, 2	Specifies the stop bit quantity. The stop bit is a signal at the end of a character that instructs a receiving device to wait for a subsequent signal. ***Note**: For asynchronous links only.*
Data Bits	7, 8	Number of data bits in a character. The default is 8. ***Note**: For asynchronous links only.*
Modem Settings		Displays a menu, which allows configuration of modem parameters. ***Note**: For asynchronous links only.*

5.5 Configuring LAN Parameters

When choosing LAN 1 100M, in the Interface Parameters screen (rather than one of the links) the following configuration options are displayed:

Table 5-16. LAN Settings

Parameters	Possible Values	Description
Autonegotiation	Enable	Autonegotiation is enabled.
	Disable	Autonegotiation is disabled.
		Default: Enabled
Speed & Duplex Mode		Specifies the speed and duplex mode of the 10/100BaseT, if autonegotiation is disabled.
		Note: *If you disable 10/100BaseT port autonegotiation when operating an opposite device with autonegotiation enabled, the port duplex mode is set to half duplex automatically.*
	100 Mbps/Full	100 Mbps, full duplex
	100 Mbps/Half	100 Mbps, half duplex
	10 Mbps/Full	10 Mbps, full duplex
	10 Mbps/Half	10 Mbps, half duplex
		Default: 100 Mbps/Full

Note

Speed & Duplex Mode settings are ignored when autonegotiation is enabled.

5.6 Configuring E1/T1 Interfaces

Select this option to configure the E1 or T1 parameters. The T1 parameters are described in the *Configuring the* T1 section on page 5-34 and the E1 parameters are described in the *Configuring E1* section on page 5-48.

FCD-IP is an integrated router/bridge with E1/T1 and fractional E1/T1 services.

FCD-IP is available in several options (refer to *Figure 5-39*, *Figure 5-40* and *Figure 5-41*)

For example:

- T1
- T1 with sublinks
- E1
- E1 with sublinks
- E1 or T1 with analog voice ports
- E1 or T1 with sublink and analog voice port.

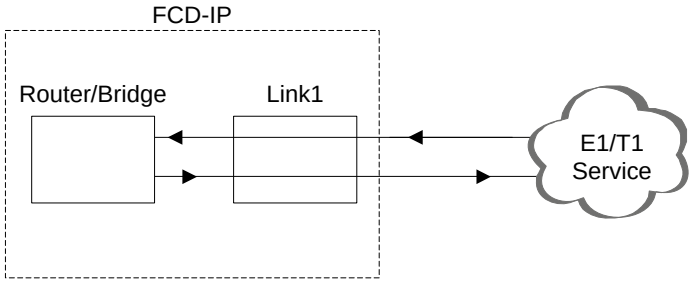


Figure 5-37. FCD-IP with an E1/T1 Interface

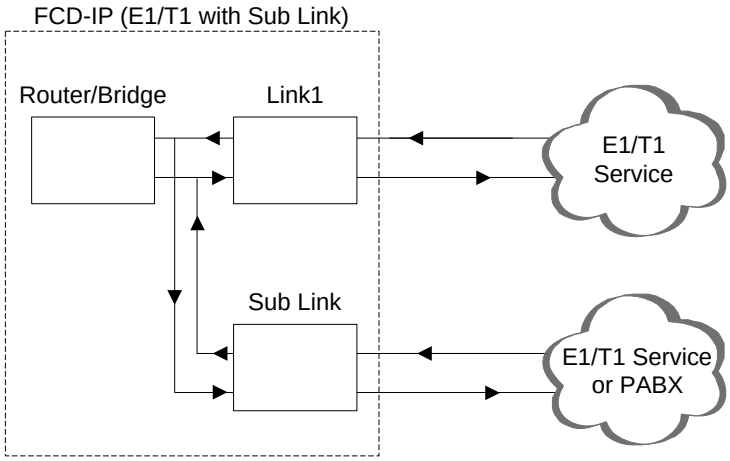


Figure 5-38. FCD-IP with an E1/T1 Interface and Sublink

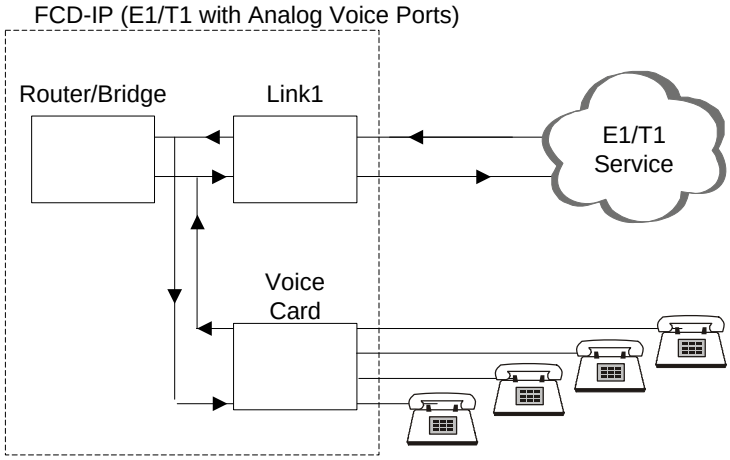


Figure 5-39. FCD-IP with an E1/T1 Interface and Analog Voice Ports

FCD-IP with sublink provides a drop & insert capability. The drop & insert capability enables multiplexing of data from the local router/bridge, and voice from the local PBX, to the E1/T1 main link.

T1 Features

- Nominal rate – 1.544 Mbps
- Data rates are multiples of 56 kbps or 64 kbps (N x 56 kbps or N x 64 kbps, N = 1–24)

- Timeslot assignment is user-selectable
- Link interface includes integral CSU/DSU depending on user configuration of the transmit level, 0 to -22.5 dB for Channel Service Unit (CSU) or 0–655 feet for Data Service Unit (DSU)
- Framing modes: Super Frame (SF (D4)) or Extended Super Frame (ESF)
- Line code: Alternate Mark Inversion (AMI)
- Zero suppression modes: B8ZS, B7ZS or transparent
- Master system clock:
  - Internal oscillator
  - Recovered from the link 1 received data
  - Recovered from the sublink received data (for FCD-IP with a sublink).
- Variety of loopback possibilities:
  - Network activated loopbacks (PLB, LLB)
  - Facility Data Link (FDL) loopbacks
  - User-configurable local or remote loopbacks.
- Extended Super Frame (ESF) diagnostic for previous 24 hours collected in 15-minute intervals (according to the AT&T PUB 54016).

E1 Features

- Nominal rate - 2.048 Mbps
- Data rates are multiples of 56 kbps or 64 kbps (N x 56 KBPS or N x 64 kbps, N = 1–31)
- Timeslot assignment is user-selectable
- E1 interface with or without LTU
- Interfaces: balanced or unbalanced (unbalanced requires an adapter cable)
- Framing modes: G732N and G732S
- Optional Cyclic Redundancy Check (CRC-4)
- Line code: HDB3
- Master system clock:
  - Internal oscillator
  - Recovered from the link 1 received data
  - Recovered from the sublink received data (for FCD-IP with a sublink).
- Loopback: User-configurable local or remote loopbacks
- When CRC-4 is enabled, diagnostics are available for the last 24 hours collected in 15-minute intervals (similar to the AT&T PUB 54016).

5.7 Configuring the T1 Interface

➤ To access the T1 Setup menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Interface Parameters > E1, T1, Voice Settings

```
T1 SETUP: LINK 1 ( Device name - FCD-IP )
----------------
1.  Clock master : [Link 1]
2.  Multiplier   : [64 kbps]
3.  Time slots mapping
4.  General Diagnostics
5.  T1 parameters
6.  Additional Cards parameters
7.  Alarms filter
8.  Advanced Setup

ESC - Return to previous menu
```

Figure 5-40. T1 Setup Menu

Table 5-17. T1 Setup Parameters

Parameters	Possible Values	Description
Clock Master		Selects the source clock that synchronizes the whole T1 network
	Internal	FCD-IP generates the system source clock from an internal clock oscillator.
	Link 1	FCD-IP recovers the clock from the data received from the T1 link1
	SUB1	For FCD-IP with a sublink:
	SUB2	FCD-IP recovers the clock from the data received from one of the T1 sublinks
	SUB3	FCD-IP recovers the clock from the data received from one of the T1 sublinks
Multiplier	56 kbps, 64 kbps	Sets the data rate of each DATA timeslot.
Time Slots Mapping		Configures the routing and the type of individual timeslots for the link. *Figure 5-43* shows the type of timeslots entering the multiplexer (MUX) (for FCD-IP with a T1 sublink)
	Data link1	For data from router/bridge, when only one E1/T1 link exists
	Data link1+2	For data from router/bridge, when two E1/T1 links exist
	SUB1 Voice	For voice from sublink 1

Parameters	Possible Values	Description
	SUB1 Data	For data from sublink 1
	Voice (1, 2, 3, 4)	For analog voice port 1, 2, 3, 4
	SUB2 Data	For data from sublink 2
	SUB2 Voice	For analog voice from sublink 2
	SUB3 Data	For data from sublink 3
	SUB3 Voice	For analog voice from sublink 3
	Channel	For data from V.xx card ***Note**: For a multiplier of 64 kbps all timeslots can be configured to DATA. But, for a multiplier of 56 kbps, a maximum of 16 timeslots can be configured to DATA.* *For FCD-IP with a T1 sublink, this limitation does not exist for timeslots configured to the VOICE or DATA SUB type.*

Note

The FCD-IP hardware configuration is dynamic and the number or type of cards in each system varies. From the values listed in the following table, only the values relevant for the actual device are displayed.

Data link 1+2 is displayed (instead of Data link 1) when the following conditions are met:

- *There are at least two E1/T1 interfaces in the device (labeled Main and Sub1 or Sub1/Link2 on the rear panel)*
- *Link 2 must not be occupied by another device (that is, the device does not include a V.xx DTE card or an ISDN card)*
- *The device does not include a second LAN port*
- *The application mode (which is configurable via RADview when the above three conditions are met) must be either Chain or Ring + Shared LAN.*

The difference between Data link 1 and Data link 1+2 is:
For Data link 1, incoming data from sub-interface 1 is automatically uplinked to the main link.
For Data link 1+2, incoming data is analyzed by the integrated router/bridge, which decides what to do with the data, thus achieving the Chain and Ring + Shared LAN applications.
Choose timeslot 0 to set all timeslots to the same values.

➤ **To access the T1 Time Slots Mapping screen:**

- Follow the screen path: **Main Menu > Advanced Setup > Setup > Interface Parameters > E1, T1, Voice Settings > Time Slots Mapping**

```
T1 TIME SLOTS MAPPING: LINK 1  ( Device name - FCD-IP )
   ----------------------------
   TS1  [DATA LINK1    ]            TS13 [NC            ]
   TS2  [DATA LINK1    ]            TS14 [NC            ]
   TS3  [NC            ]            TS15 [NC            ]
   TS4  [NC            ]            TS16 [NC            ]
   TS5  [SUB1-VOICE    ]            TS17 [NC            ]
   TS6  [SUB1-VOICE    ]            TS18 [NC            ]
   TS7  [SUB2-DATA     ]            TS19 [NC            ]
   TS8  [NC            ]            TS20 [NC            ]
   TS9  [NC            ]            TS21 [NC            ]
   TS10 [NC            ]            TS22 [NC            ]
   TS11 [NC            ]            TS23 [NC            ]
   TS12 [NC            ]            TS24 [NC            ]

    Enter time slot number (0 refers to all the time slots)
    Press 'ENTER' - to toggle the time slot type
    Press 'ESC'   - to Return to previous menu
    Time slot number :
```

Figure 5-41. T1 Time Slots Mapping Screen

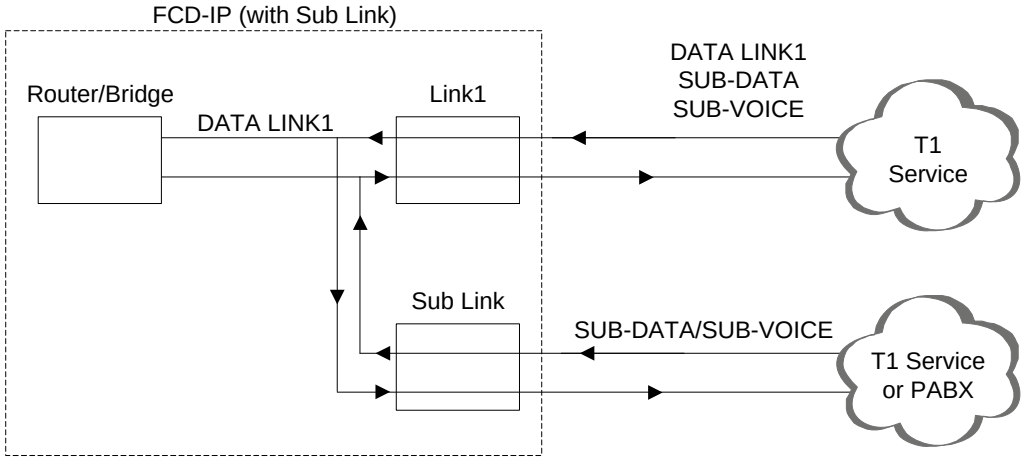


Figure 5-42. Time Slots Mapping (for FCD-IP with a T1 Sublink)

Configuring T1 Link Parameters

➤ To access the T1 Parameters Link1 menu:

- Follow the screen path: **Main Menu › Advanced Setup › Setup › Interface Parameters › E1, T1, Voice Settings › T1 Link Parameters**

```
T1 PARAMETERS: LINK 1 ( Device name - FCD-IP )
---------------------

1.  Frame type     : [ESF]
2.  Line code      : [B8ZS]
3.  Tx line mask   : [0-133 ft / 0 dB]
4.  Sync           : [FAST]
5.  Idle code (hex): 7C
6.  Rx gain        : [36 dB]

ESC - Return to previous menu
```

Figure 5-43. T1 Parameters Link1 Menu

Note

The list of options may vary according to the system configuration. Additional options to those shown in the figure above may be included and are listed below.

Table 5-18. T1 Parameters Link1 Parameters

Parameters	Possible Values	Description
Frame Type		Sets the T1 framing type
	ESF	24 frames per multiframe
	SF	12 frames per multiframe
Line Code	B7ZS B8ZS Transparent	Sets the line coding method used for zero suppression. The zero suppression method is used to avoid long strings of '0', because these strings do not carry timing information.
Tx Line Mask	0–133 ft / 0 dB 133–266 ft 266–399 ft 399–533 ft 533–655 ft 7.5 dB 15 dB 22.5 dB	Controls the link transmit signal characteristics. Options depend on whether the link should be configured with CSU. When the link is configured without CSU, the transit signal mask is selected according to the transit line length (0-655 ft.), to meet DSX-1 requirements. When the link is configured with CSU, the transit signal is attenuated by 7.5, 15, or 22.5 dB.
Sync		Defines the time required for the link to return to normal operation after a red alarm event has terminated.
	FAST	1 second
	AT&T 62411	10 seconds
Idle Code	00 to FF	Sets the value to be transmitted on the NC time slots
Rx Gain	15 dB, 36 dB	Sets the maximum receive sensitivity for the T1 interface

Parameters	Possible Values	Description
Remote Alarm Indication (for FCD-IP with a Sublink)		When configuring this parameter from the T1 Parameters menu, select this parameter to determine whether to transmit a yellow alarm indication on the T1 sublink when Link 1 is in yellow alarm state. When configuring this parameter from the Sublink T1 Parameters menu, select this parameter to determine whether to transmit a yellow alarm indication on Link 1 when sublink T1 is in either yellow or red alarm state. ***Note**: When Link 1 is in red alarm state, an "all ones" indication is sent to all of the T1 sublinks.*
Out-Of-Service Signaling (for FCD-IP with a sublink)		Determines the value of the A, B signaling bits sent to Link 1 when the sublink is in the Out-Of-Service state. The C and D signaling bits are not affected.
	MARK	Both A and B signaling bits are forced to '1' during out-of-service period
	SPACE	Both A and B signaling bits are forced to '0' during out-of-service period
	MARK-SPACE	The A and B signaling bits are forced to '1' for 2.5 seconds, then shift to the '0' state until the out-of-service period ends
	SPACE-MARK	The A and B signaling bits are forced to '0' for 2.5 seconds, then shift to the '1' state until the out-of-service period ends.
Sublink Status (for FCD-IP with a sublink)	Enable or Disable	

Configuring Additional Card Parameters

Select this option to allow you to select the card for which parameters are to be displayed. A toggle option appears on the bottom of the screen. Use the spacebar to toggle between the card types. Press **<Enter>** to access the parameters screen.

Card options are:

- **Sub** – depending on your hardware installation options are:
  - Sub1 – parameters for T1 are shown in *Configuring T1 Link Parameters*.
  - Sub2
  - Sub3.
- **Voice**
  - Voice.

Configuring FXS Voice Interface

➤ To access the FXS Voice Interface screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Interface Parameters > E1, T1, Voice Settings > Additional Cards Parameters > FXS Voice Interface

```
VOICE PARAMETERS: ( Device name - FCD-IP , VOICE)
 -----------------
 1. TX/RX gains
 2. Coding law                 : [μ LAW]
 3. On/off-hook from the T1 on : [A bit]
 4. On/off-hook to the T1 on   : [A bit]
 5. Default ABCD to the T1     : [0001]
 6. Polarity                   : [Disabled]
 ESC - Return to previous menu
 Choose one of the above:
```

Figure 5-44. FXS Voice Interface

Selecting RX/TX Gains

Select this parameter to specify the nominal input level of the receive and transmit paths for each voice port. The input level range is –10 to +5 dBm.

Defining Coding Law

Select this parameter to specify the compounding law to be used by the voice channels. The values are:

μ Law Coding for T1 links.

Selecting on/off-hook from the T1 On

Select this parameter to specify the receive mode for on/off-hook signaling from T1 into FXS. The values are:

A bit — When the received A bit signal from T1 equals 1 then off-hook will be indicated in the FXS interface
When the received A bit signal from T1 equals 0 then on-hook will be indicated in the FXS interface

A bit inverted — When the received A bit signal from T1 equals 1 then on-hook will be indicated in the FXS interface
When the received A bit signal from T1 equals 0 then off-hook will be indicated in the FXS interface

B bit — When the received B bit signal from T1 equals 1 then off-hook will be indicated in the FXS interface
When the received B bit signal from T1 equals 0 then on-hook will be indicated in the FXS interface

B bit inverted — When the received B bit signal from T1 equals 1 then on-hook will be indicated in the FXS interface

When the received B bit signal from T1 equals 0 then off-hook will be indicated in the FXS interface

Selecting on/off-hook to the T1 On

Select this parameter to specify the transmission mode for on/off-hook signaling from FXS to T1. The values are:

A bit For off-hook indicated in the FXS interface, the transmitted A bit signal will be set to 1 towards T1
For on-hook indicated in the FXS interface, the transmitted A bit signal will be set to 0 towards T1

A bit inverted For off-hook indicated in the FXS interface, the transmitted A bit signal will be set to 0 towards T1
For on-hook indicated in the FXS interface, the transmitted A bit signal will be set to 1 towards T1

B bit For off-hook indicated in the FXS interface, the transmitted B bit signal will be set to 1 towards T1
For on-hook indicated in the FXS interface, the transmitted B bit signal will be set to 0 towards T1

B bit inverted For off-hook indicated in the FXS interface, the transmitted B bit signal will be set to 0 towards T1
For on-hook indicated in the FXS interface, the transmitted B bit signal will be set to 1 towards T1.

Setting Default ABCD to the T1

Select this parameter to specify signaling bits that are not in use for the on/off-hook or for the polarity (if enabled). Those bits will be transmitted towards T1.

Defining Polarity (Polarity Reversal, also known as Wink Start Reversal)

When polarity is configured as *Enabled,* the polarity signal is received from T1 either on the B bit (while the *on/off-hook from T1/E1* parameter is configured to *A bit* or *A bit inverted),* or on the A bit (while the *on/off-hook from T1/E1* parameter is configured to *B bit* or *B bit inverted).*

Configuring FXO Voice Interface

➤ **To access the FXS Voice Interface screen:**

- Follow the screen path: **Main Menu › Advanced Setup › Setup › Interface Parameters › E1, T1, Voice Settings › Additional Cards Parameters › FXO Voice Interface**

```
VOICE PARAMETERS:   ( Device name - FCD-IP , Voice)
 -----------------

 1.  TX/RX gains
 2.  Coding law                 : [µ LAW]
 3.  On/off-hook from the T1 on : [A bit]
 4.  Ring Detection to the T1 on: [A bit]
 5.  Default ABCD to the T1     : [0000]
 6.  Polarity                   : [Disabled]
 7.  Signaling Feedback         : [Disabled]
 8.  Out of Service method      : [Forced Idle]

 ESC - Return to previous menu

 Choose one of the above:
```

Figure 5-45. FXO Voice Interface

Selecting RX/TX Gains

Select this parameter to specify the nominal input level of the receive and transmit paths for each voice port. The input level range is –10 to +5 dBm.

Selecting Coding Law

Select this parameter to specify the compounding law to be used by the voice channels. The values are:

µ Law Coding for T1 links.

Defining on/off-hook from the T1 On

Select this parameter to specify the receive mode for on/off-hook signaling from T1 into FXO. The values are:

A bit — When the received A bit signal from T1 equals 1 then off-hook will be indicated in the FXO interface
When the received A bit signal from T1 equals 0 then on-hook will be indicated in the FXO interface

A bit inverted — When the received A bit signal from T1 equals 1 then on-hook will be indicated in the FXO interface
When the received A bit signal from T1 equals 0 then off-hook will be indicated in the FXO interface

B bit — When the received B bit signal from T1 equals 1 then off-hook will be indicated in the FXO interface
When the received B bit signal from T1 equals 0 then on-hook will be indicated in the FXO interface

B bit inverted — When the received B bit signal from T1 equals 1 then on-hook will be indicated in the FXO interface
When the received B bit signal from T1 equals 0 then off-hook will be indicated in the FXO interface.

Specifying Ring Detection to T1 On

Select this parameter to specify the ring detection signaling transmission mode from FXO towards T1. The values are:

A bit For ring detection the A bit signaling will be set to 1 towards T1
For no ring detection the A bit signaling will be set to 0 towards T1

A bit inverted For ring detection the A bit signaling will be set to 0 towards T1
For no ring detection the A bit signaling will be set to 1 towards T1

B bit For ring detection the B bit signaling will be set to 1 towards T1
For no ring detection the B bit signaling will be set to 0 towards T1

B bit inverted For ring detection the B bit signaling will be set to 0 towards T1
For no ring detection the B bit signaling will be set to 1 towards T1.

Defining Default ABCD to the T1

This parameter specifies the default signaling bits that are not used for ring detection or for polarity (if *Enabled*). Those bits will be transmitted towards T1.

Defining Polarity (Polarity Reversal, also known as Wink Start Reversal)

When polarity is configured as *Enabled,* the polarity signal is received from T1 either on the B bit (while the *on/off-hook from T1/E1* parameter is configured to *A bit* or *A bit inverted),* or on the A bit (while the *on/off-hook from T1/E1* parameter is configured to *B bit* or *B bit inverted).*

Configuring Signaling Feedback

This parameter is set to:

Enabled feedback of the *on/off-hook signaling* that was received from T1 is transmitted back to T1

Disabled feedback of the *on/off-hook signaling* that was received from T1 is not transmitted back to T1.

Defining Out of Service Method

This parameter specifies the *on/off-hook signaling* in FXO when an *Out of Service* condition is indicated in the T1 link. The values are:

Forced Idle signaling is held *on-hook* for the duration of the *Out of Service* condition

Forced Busy signaling is held *off-hook* for the duration of the *Out of Service* condition.

Configuring E & M Voice Interface

➤ To access the E & M Voice Interface screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Interface Parameters > E1, T1, Voice Settings > Additional Cards Parameters> E&M Voice Interface

```
VOICE PARAMETERS: ( Device name - FCD-IP Voice )
 -----------------

 1.  TX/RX gains
 2.  Interface type         : [4W]
 3.  E&M type                          : [A bit]
 4.  Coding law                          : [µ LAW]
 5.  E signal from the T1 on: [A bit]
 6.  M signal to the T1 on  : [A bit]
 7.  Default ABCD to the T1 : [0000]
 8.  Out of Service method  : [Forced Idle]

 ESC - Return to previous menu

 Choose one of the above:
```

Figure 5-46. E & M Voice Interface

Defining RX/TX Gains

Select this parameter to specify the nominal input level of the receive and transmit paths for each voice port. The TX level range is –10 to +5 dBm and the RX level range is –10 to +2 dBm.

Selecting Interface Type

This parameter specifies the interface type:

2W two-wire interface

4W four-wire interface.

Selecting E&M Type

This parameter specifies the E&M signaling mode:

- Type1
- Type2
- Type3
- Type5 – SSDC5.

Note *The E&M voice channels are always open, once timeslots for the voice have been allocated on the T1, even without the use of signaling.*

Specifying Coding Law

Select this parameter to specify the compounding law to be used by the voice channels. The values are:

- **μ Law Coding** – for T1 links.

Defining E Signal from the T1 On

Select this parameter to specify the E signal receive mode from T1 into E&M. The values are:

A bit When the received A bit signal from T1 equals 1 then the E signal will be activated in the E&M interface
When the received A bit signal from T1 equals 0 then the E signal will be inactivated in the E&M interface

A bit inverted When the received A bit signal from T1 equals 0 then the E signal will be activated in the E&M interface
When the received A bit signal from T1 equals 1 then the E signal will be inactivated in the E&M interface

B bit When the received B bit signal from T1 equals 1 then the E signal will be activated in the E&M interface
When the received B bit signal from T1 equals 0 then the E signal will be inactivated in the E&M interface

B bit inverted When the received B bit signal from T1 equals 0 then the E signal will be activated in the E&M interface
When the received B bit signal from T1 equals 1 then the E signal will be inactivated in the E&M interface.

Selecting Default ABCD to the T1

This parameter specifies the default signaling bits that are not used for the M signal. Those bits will be transmitted towards T1.

Specifying Out of Service Method

This parameter specifies the *E signaling state in E&M* when an *Out of Service* condition is indicated in the T1 link. The values are:

Forced Idle T1 signal is held at *inactive* for the duration of the *Out of Service* condition

Forced Busy T1 signal is held at *active* for the duration of the *Out of Service* condition

Idle Busy T1 signal is held at *inactive* for 2.5 seconds, and then toggled to *active* until the *Out of Service* condition end

Busy Idle T1 signal is held at *active* for 2.5 seconds, and then toggled to *inactive* until the *Out of Service* condition end.

Assigning Timeslots for Voice Ports

Refer to *Table 5-17.*

➤ To access the T1 Time Slots Mapping Link1 screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Interface Parameters > E1, T1, Voice Settings > Time Slots Mapping

A typical screen is shown in *Figure 5-49*.

```
T1 TIME SLOTS MAPPING: LINK 1  ( Device name - FCD-IP )
   ----------------------------

   TS1  [DATA LINK1    ]            TS13 [NC            ]
   TS2  [DATA LINK1    ]            TS14 [NC            ]
   TS3  [NC            ]            TS15 [NC            ]
   TS4  [NC            ]            TS16 [NC            ]
   TS5  [SUB1-VOICE    ]            TS17 [NC            ]
   TS6  [SUB2-VOICE    ]            TS18 [NC            ]
   TS7  [SUB1-DATA     ]            TS19 [NC            ]
   TS8  [NC            ]            TS20 [NC            ]
   TS9  [NC            ]            TS21 [NC            ]
   TS10 [NC            ]            TS22 [NC            ]
   TS11 [NC            ]            TS23 [NC            ]
   TS12 [NC            ]            TS24 [NC            ]

    Enter time slot number (0 refers to all the time slots)
    Press 'ENTER' - to toggle the time slot type
    Press 'ESC'   - to Return to previous menu
    Time slot number :
```

Figure 5-47. T1 Time Slots Mapping Link1 Screen

Advanced Setup Menu

Select this option to configure the Application-mode and in-band management on E1/T1 links. The management is performed using a dedicated timeslot and can be enabled on the main link and Sub 1 (if it exists). You can configure which timeslot to use, and is the same for both links.

Use the advanced setup menu to configure normal, chain, ring, or ring + shared LAN modes of operation.

The management host IP is a unique address, different than the LAN or WAN IP addresses that may be configured elsewhere in the device. This IP address is used for SNMP, Telnet, TFTP downloads and ping via the in-band management channel.

Note

- *Inband management links are established over PPP. Keep this in mind when connecting FCD-IP with another device, such as a Megaplex.*
- *RAD RIP proprietary routing protocol is used to dynamically learn and propagate management related routing information. Routing information learned from management links is not displayed in the general routing table, but in a dedicated screen, accessible from the View menu.*
- *Older versions of FCD-IP can be configured to periodically send a single-entry RIP-2 update about themselves, via their dedicated management timeslot. This enables other devices that are connected to them to learn their management IP address dynamically. Since RAD RIP is now implemented, there is no further need to support this option; however, for backward compatibility with older versions of FCD-IP, newer versions (4.00 and higher) are still capable of learning from these RIP-2 updates.*

➤ To access the Advanced Setup menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Interface Parameters > E1, T1, Voice Settings > Advanced Setup

```
     ADVANCED SETUP  ( Device name - FCD-IP )

  1. Application Mode (RESET)                  : [Normal]
  2. Management Link Status                    :
  3. Management Link Time Slot Number (RESET)  : 31
  4. Management Host IP Address                : 007.007.007.007
  5. Management Host MTU                       : 200
  6. Management Learning Ageing (minutes)      : 5
  7. Traps/TFTP Via Inband Mng. Links          : [Disable]
  8. Management Protocol (RESET)               : [Proprietary]
```

Figure 5-48. Advanced Setup Menu – Normal

```
     ADVANCED SETUP  ( Device name - FCD-IP )

  1. Application Mode (RESET)             : [Chain]
  2. Management Link 1 Status             :
  3. Management SUB1 Status               :
  4. Management Time Slot Number (RESET)  : 31
  5. Management Host IP Address           : 007.007.007.007
  6. Management Host MTU                  : 200
  7. Management Learning Ageing (minutes) : 5
  8. Traps/TFTP Via Inband Mng. Links     : [Disable]
  9. Double Loop Detection                : [Disable]
  :. Management Protocol (RESET)          : [Proprietary]
```

Figure 5-49. Advanced Setup Menu – Chain

```
     ADVANCED SETUP  ( Device name - FCD-IP )

  1. Application Mode (RESET)             : [Ring+Shared LAN]
  2. Management Time Slot Number (RESET)  : 31
  3. Management Host IP Address           : 007.007.007.007
  4. Management Host MTU                  : 200
  5. Management Learning Ageing (minutes) : 5
  6. Line Recovery Mode                   : [Normal]
  7. Recovery Timeout (seconds)           : 12
  8. Traps/TFTP Via Inband Mng. Links     : [Disable]
  9. Double Loop Detection                : [Disable]
  :. Management Protocol (RESET)          : [Proprietary]
```

Figure 5-50. Advanced Setup Menu – Ring and Ring + Shared LAN

Table 5-18. Advanced Setup Parameters

Parameters	Possible Values	Description
Application Mode	Normal	Normal mode is used when one E1/T1 only is needed (and for all older versions of FCD-IP)
	Chain	Chain mode adds an additional E1/T1 link, enabling traffic from Sub 1 as well as from the main link to be processed by the integrated router/bridge ***Note:*** *Only values that are relevant to the hardware configuration of the current FCD-IP are displayed. For example, Ring is not displayed on T1 devices since Ring mode is only available for E1.*
Management LINK 1 Status	Disable Enable	
Management Link 2 Status	Disable Enable	***Note:*** *This parameter is only available when it is possible to have link 2, depending on the hardware configuration*
Management Time Slot Number (RESET)	1..24 (timeslot 16 is not available when a voice card exists)	The timeslot that will be dedicated for management traffic. The same timeslot is used for both management links (when both are enabled) ***Note:*** *The device will reset upon change of this parameter.*
Management Host IP Address	Valid IP address	IP address of the device that is used for all management traffic
Management Host MTU	100..1500	Management link Maximum Transmit Unit. The default is **200**, in order to be compatible with other RAD devices, for example, Megaplex
Management Learning Ageing (minutes)	0..9999	If no RAD RIP update (about a management routing entry) is received for this time period, the entry is removed from the management routing table 0 means up to 1 minute, 1 means up to 2 minutes, etc **Default: 5**

Parameters	Possible Values	Description
Recovery Timeout (seconds)	0..99	If a Ring link is down, FCD-IP will not try to reestablish it for the Recovery Timeout duration, even if it is synchronized on the E1 level. This prevents Ring multiple state changes in jittery lines. 0 means immediate recovery ***Note:*** *This parameter is only available when Application Mode is Ring or Ring + Shared LAN.*
Management via Inband Links	Disable Enable	When enabled, SNMP traps and TFTP will go to the inband management link. When disabled, they will go to the other interfaces (for example, to the LAN).
Double Loop Detection	Disable Enable	Disable – single line failures detected only Enable – multiple line failures are detected
Management Protocol	Normal Proprietary	Normal – use for FCD-IP versions 3.0 and less Proprietary – use for FCD-IP versions 4.0 and higher

5.8 Configuring E1 Interface

This section describes the parameters in the E1 Setup menu.

➤ **To access the E1 Setup menu:**

- Follow the screen path: **Main Menu > Advanced Setup > Setup > Interface Parameters > E1, T1, Voice Settings**

```
 E1 Setup: LINK 1 ( Device name – FCD-IP )
------------------
 1. Clock Master: [Link 1]
 2. Multiplier  : [64 kbps]
 3. Time slots mapping
 4. General Diagnostics
 5. E1 parameters
 6. Additional Cards parameters
 7. Alarms filter
 8. Advanced Setup

 ESC – Return to previous menu
 Choose one of the above:
```

Figure 5-51. E1 Setup Menu

Table 5-19. E1 Setup Parameters

Parameters	Possible Values	Description
Clock Master		Selects the source clock that synchronizes the whole E1 network
	Internal	FCD-IP generates the system source clock from an internal clock oscillator.
	Link 1	FCD-IP recovers the clock from the data received from the E1 link1
	SUB1	For FCD-IP with a sublink
	SUB2	FCD-IP recovers the clock from the data received from one of the E1 sublinks
	SUB3	FCD-IP recovers the clock from the data received from one of the E1 sublinks
Multiplier	56 kbps, 64 kbps	Sets the data rate of each DATA timeslot.
Time Slots Mapping		Configures the routing and the type of individual timeslots for the link. *Figure 5-54* shows the type of timeslots entering the multiplexer (MUX) (for FCD-IP with an E1 sublink)
	Data link1	For data from router/bridge, when only one E1/T1 link exists
	Data link1+2	For data from router/bridge, when two E1/T1 links exist
	SUB1 Voice	For voice from sublink 1
	SUB1 Data	For data from sublink 1
	Voice (1, 2, 3, 4)	For analog voice port 1, 2, 3, 4
	SUB2 Data	For data from sublink 2
	SUB2 Voice	For analog voice from sublink 2
	SUB3 Data	For data from sublink 3
	SUB3 Voice	For analog voice from sublink 3
	Channel	For data from V.xx card ***Note**: For a multiplier of 64 kbps all timeslots can be configured to DATA. But, for a multiplier of 56 kbps, a maximum of 16 timeslots can be configured to DATA.* *For FCD-IP with an E1 sublink, this limitation does not exist for timeslots configured to the VOICE or DATA SUB type.*

Notes *The FCD-IP hardware configuration is dynamic and the number or type of cards in each system varies. From the values listed in the following table, only the values relevant for the actual device are displayed.*

Data link 1+2 is displayed (instead of Data link 1) when the following conditions are met:

- *There are at least two E1/T1 interfaces in the device (labeled Main and Sub1 or Sub1/Link2 on the rear panel)*
- *Link 2 must not be occupied by another device (that is, the device does not include a V.xx DTE card or an ISDN card)*
- *The device does not include a second LAN port*
- *The application mode (which is configurable via RADview when the above three conditions are met) must be either Chain or Ring + Shared LAN.*

The difference between Data link 1 and Data link 1+2 is:
For Data link 1, incoming data from sub-interface 1 is automatically uplinked to the main link.
For Data link 1+2, incoming data is analyzed by the integrated router/bridge, which decides what to do with the data, thus achieving the Chain and Ring + Shared LAN applications.
Choose timeslot 0 to set all timeslots to the same values.

➤ To access the E1 Time Slots Mapping screen:

- Follow the screen path: Main Menu › Advanced Setup › Setup › Interface Parameters › E1, T1, Voice Settings › Time Slots Mapping

```
E1 TIME SLOTS MAPPING: LINK1 ( Device name – FCD-IP )
---------------------
   TS1  [DATA LINK1    ]     TS17 [NC            ]
   TS2  [SUB1-VOICE    ]     TS18 [NC            ]
   TS3  [SUB1-DATA     ]     TS19 [NC            ]
   TS4  [NC            ]     TS20 [NC            ]
   TS5  [NC            ]     TS21 [NC            ]
   TS6  [NC            ]     TS22 [NC            ]
   TS7  [NC            ]     TS23 [NC            ]
   TS8  [NC            ]     TS24 [NC            ]
   TS9  [NC            ]     TS25 [NC            ]
   TS10 [NC            ]     TS26 [NC            ]
   TS11 [NC            ]     TS27 [NC            ]
   TS12 [NC            ]     TS28 [NC            ]
   TS13 [NC            ]     TS29 [NC            ]
   TS14 [NC            ]     TS30 [NC            ]
   TS15 [NC            ]     TS31 [NC            ]
   TS16 [NC            ]

 Enter time slot number (0 refer to all time slots)
 Press 'ENTER' – to toggle the time slot type
 Press 'ESC' - to Return to previous menu
 Time slot number: 5
```

Figure 5-52. E1 Time Slots Mapping Screen

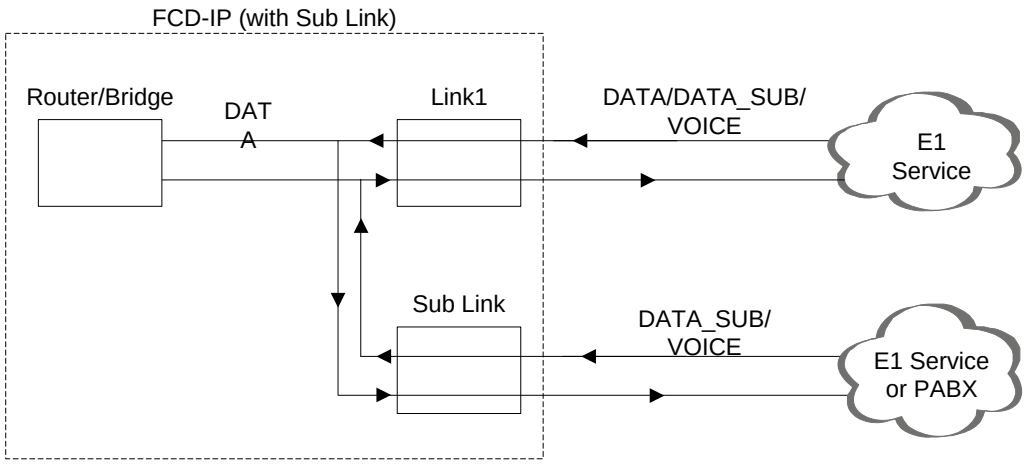


Figure 5-53. Timeslots Mapping (for FCD-IP with an E1 Sublink)

Defining E1 Link Parameters

Select this option to configure the parameters that follow.

➤ To access the E1 Parameters screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Interface Parameters > E1, T1, Voice Settings > E1 Link Parameters

```
E1 PARAMETERS: LINK 1 ( Device name – FCD-IP )
------------------------------


1. Frame type              : [G732S]
2. CRC-4                   : [ON]
3. Sync                    : [FAST]
4. Idle code (hex)         : 7C
5. Rx gain                 : [30 dB]
6. Line type (RESET)       : [Balanced]
7. Remote Alarm Indication : [OFF]

ESC – Return to previous menu

Choose one of the above:
```

Figure 5-54. E1 Parameters

Table 5-20. E1 Link1 Parameters

Parameters	Possible Values	Description
Frame Type	G732N	2 frames per multiframe. Time slot 16 can be used for user data.
	G732S	16 frames per multiframe. Time slot 16 is used for the Channel Associated Signaling (CAS).
CRC-4	On, Off	Cyclic Redundancy Check – enables or disables calculation of 4-bits check sum in order to detect errors in frames

Parameters	Possible Values	Description
Sync		Defines the time required for the link to return to normal operation after a red alarm event has terminated.
	FAST	1 second
	AT&T 62411	10 seconds
	CCITT	100 msec.
Idle Code	00 to FF	Sets the value to be transmitted on the NC time slots
Rx Gain	12 dB, 30 dB	Sets the maximum receive sensitivity for the E1 interface
Out-Of-Service Signaling (for FCD-IP with a sublink)		Determines the value of the A, B signaling bits sent to Link 1 when the sublink is in the Out-Of-Service state. The C and D signaling bits are not affected.
	Mark	Both A and B signaling bits are forced to '1' during out-of-service period
	Space	Both A and B signaling bits are forced to '0' during out-of-service period
	Mark-space	The A and B signaling bits are forced to '1' for 2.5 seconds, then shift to the '0' state until the out-of-service period ends
	Space-mark	The A and B signaling bits are forced to '0' for 2.5 seconds, then shift to the '1' state until the out-of-service period ends.
Sublink Status (for FCD-IP with a sublink)	Enable or Disable	
Line Type	Balanced Unbalanced	Set the Line Type to Unbalanced when using the RJ-45 to BNC adapter cable
Remote Alarm Indication (for FCD-IP with a sublink)		When configuring this parameter from the E1 Parameters menu, select this parameter to determine whether to transmit a yellow alarm indication on the E1 sublink when Link 1 is in yellow alarm state. When configuring this parameter from the Sublink E1 Parameters menu, select this parameter to determine whether to transmit a yellow alarm indication on Link 1 when sublink E1 is in either yellow or red alarm state. ***Note**: When Link 1 is in red alarm state, an "all ones" indication is sent to all of the E1 sublinks.*

Defining Additional Card Parameters

Select this option to allow you to select the card for which parameters are to be displayed. A toggle option appears on the bottom of the screen. Use the Space bar to toggle between the card types. Press Enter to access the parameters screen.

Card options are:

- **Sub –** depending on your hardware installation options are:
  - Sub1 – parameters for E1 are shown as those in *Table 5-20*
  - Sub2
  - Sub3.
- Voice
  - Voice.

Configuring FXS Voice Interface

➤ To access the FXS Voice Parameters screen:

- Follow the screen path: **Main Menu › Advanced Setup › Setup › Interface Parameters › E1, T1, Voice Settings › Additional Cards Parameters › FXS Voice Interface**

```
VOICE PARAMETERS: ( Device name - FCD-IP , VOICE)
-----------------

1. TX/RX gains
2. Coding law                 : [A LAW]
3. On/off-hook from the E1 on : [A bit]
4. On/off-hook to the E1 on   : [A bit]
5. Default ABCD to the E1     : [0001]
6. Polarity                   : [Disabled]

ESC - Return to previous menu

Choose one of the above:
```

Figure 5-55. FXS Voice Parameters

Setting TX/RX Gains

Select this parameter to specify the nominal input level of the receive and transmit paths for each voice port. The input level range is –10 to +5 dBm.

Selecting Coding Law

Select this parameter to specify the compounding law to be used by the voice channels. The values are:

A Law coding for E1 links

Selecting on/off-hook from the E1 on

Select this parameter to specify the receive mode for on/off-hook signaling from E1 into FXS. The values are:

A bit When the received A bit signal from E1 equals 1 then off-hook will be indicated in the FXS interface

When the received A bit signal from E1 equals 0 then on-hook will be indicated in the FXS interface

A bit inverted When the received A bit signal from E1 equals 1 then on-hook will be indicated in the FXS interface
When the received A bit signal from E1 equals 0 then off-hook will be indicated in the FXS interface

B bit When the received B bit signal from E1 equals 1 then off-hook will be indicated in the FXS interface
When the received B bit signal from E1 equals 0 then on-hook will be indicated in the FXS interface

B bit inverted When the received B bit signal from E1 equals 1 then on-hook will be indicated in the FXS interface
When the received B bit signal from E1 equals 0 then off-hook will be indicated in the FXS interface

Selecting on/off-hook to the E1 on

Select this parameter to specify the transmission mode for on/off-hook signaling from FXS to E1. The values are:

A bit For off-hook indicated in the FXS interface, the transmitted A bit signal will be set to 1 towards E1
For on-hook indicated in the FXS interface, the transmitted A bit signal will be set to 0 towards E1

A bit inverted For off-hook indicated in the FXS interface, the transmitted A bit signal will be set to 0 towards E1
For on-hook indicated in the FXS interface, the transmitted A bit signal will be set to 1 towards E1

B bit For off-hook indicated in the FXS interface, the transmitted B bit signal will be set to 1 towards E1
For on-hook indicated in the FXS interface, the transmitted B bit signal will be set to 0 towards E1

B bit inverted For off-hook indicated in the FXS interface, the transmitted B bit signal will be set to 0 towards E1
For on-hook indicated in the FXS interface, the transmitted B bit signal will be set to 1 towards E1.

Selecting Default ABCD to the E1

Select this parameter to specify signaling bits that are not in use for the on/off-hook or for the polarity (if enabled). Those bits will be transmitted towards E1.

Selecting Polarity (Polarity Reversal, also known as Wink Start Reversal)

When polarity is configured as *Enabled,* the polarity signal is received from E1 either on the B bit (while the *on/off-hook from T1/E1* parameter is configured to *A bit* or *A bit inverted),* or on the A bit (while the *on/off-hook from T1/E1* parameter is configured to *B bit* or *B bit inverted).*

Configuring FXO Voice Interface

➤ To access the FXS Voice Parameters screen:

- Follow the screen path: Main Menu › Advanced Setup › Setup › Interface Parameters › E1, T1, Voice Settings › Additional Cards Parameters › FXO Voice Interface

```
VOICE PARAMETERS:   ( Device name - FCD-IP , FXO)
-----------------

1.  TX/RX gains
2.  Coding law                 : [A LAW]
3.  On/off-hook from the E1 on : [A bit]
4.  Ring Detection to the E1 on: [A bit]
5.  Default ABCD to the E1     : [0000]
6.  Polarity                   : [Disabled]
7.  Signaling Feedback         : [Disabled]
8.  Out of Service method      : [Forced Idle]

ESC - Return to previous menu

Choose one of the above:
```

Figure 5-56. FXO Voice Interface

Selecting TX/RX Gains

Select this parameter to specify the nominal input level of the receive and transmit paths for each voice port. The input level range is –10 to +5 dBmm.

Defining Coding Law

Select this parameter to specify the compounding law to be used by the voice channels. The values are:

A Law coding for E1 links

Selecting on/off-hook from the E1 on

Select this parameter to specify the receive mode for on/off-hook signaling from E1 into FXO. The values are:

A bit — When the received A bit signal from E1 equals 1 then off-hook will be indicated in the FXO interface
When the received A bit signal from E1 equals 0 then on-hook will be indicated in the FXO interface

A bit inverted — When the received A bit signal from E1 equals 1 then on-hook will be indicated in the FXO interface
When the received A bit signal from E1 equals 0 then off-hook will be indicated in the FXO interface

B bit When the received B bit signal from E1 equals 1 then off-hook will be indicated in the FXO interface
When the received B bit signal from E1 equals 0 then on-hook will be indicated in the FXO interface

B bit inverted When the received B bit signal from E1 equals 1 then on-hook will be indicated in the FXO interface
When the received B bit signal from E1 equals 0 then off-hook will be indicated in the FXO interface.

Configuring Ring Detection to E1 on

Select this parameter to specify the ring detection signaling transmission mode from FXO towards E1. The values are:

A bit For ring detection the A bit signaling will be set to 1 towards E1
For no ring detection the A bit signaling will be set to 0 towards E1

A bit inverted For ring detection the A bit signaling will be set to 0 towards E1
For no ring detection the A bit signaling will be set to 1 towards E1

B bit For ring detection the B bit signaling will be set to 1 towards E1
For no ring detection the B bit signaling will be set to 0 towards E1

B bit inverted For ring detection the B bit signaling will be set to 0 towards E1
For no ring detection the B bit signaling will be set to 1 towards E1.

Configuring Default ABCD to the E1

This parameter specifies the default signaling bits that are not used for ring detection or for polarity (if *Enabled*). Those bits will be transmitted towards E1.

Specifying Polarity (Polarity Reversal, also Known as Wink Start Reversal)

When polarity is configured as *Enabled,* the polarity signal is received from E1 either on the B bit (while the *on/off-hook from T1/E1* parameter is configured to *A bit* or *A bit inverted),* or on the A bit (while the *on/off-hook from T1/E1* parameter is configured to *B bit* or *B bit inverted).*

Selecting Signaling Feedback

This parameter is set to:

Enabled feedback of the *on/off-hook signaling* that was received from E1 is transmitted back to E1

Disabled feedback of the *on/off-hook signaling* that was received from E1 is not transmitted back to E1.

Selecting Out of Service Method

This parameter specifies the *on/off-hook signaling* in FXO when an *Out of Service* condition is indicated in the E1 link. The values are:

Forced Idle signaling is held *on-hook* for the duration of the *Out of Service* condition

Forced Busy signaling is held *off-hook* for the duration of the *Out of Service* condition.

Configuring E & M Voice Interface

➤ To access the FXS Voice Parameters screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Interface Parameters > E1, T1, Voice Settings > Additional Cards Parameters > E&M Voice Interface

```
VOICE PARAMETERS: ( Device name - FCD-IP E&M )
-----------------

1.  TX/RX gains
2.  Interface type         : [4W]
3.  E&M type                          : [A bit]
4.  Coding law                          : [A LAW]
5.  E signal from the E1 on: [A bit]
6.  M signal to the E1 on  : [A bit]
7.  Default ABCD to the E1 : [0000]
8.  Out of Service method  : [Forced Idle]

ESC - Return to previous menu

Choose one of the above:
```

Figure 5-57. E & M Voice Interface

Selecting RX/TX Gains

Select this parameter to specify the nominal input level of the receive and transmit paths for each voice port. The TX level range is –10 to +5 dBm and the RX level range is –10 to +2 dBm.

Selecting Interface Type

This parameter specifies the interface type:

2W 2-wire interface

4W 4-wire interface.

Specifying E&M Type

This parameter specifies the E&M signaling mode:

- Type1
- Type2
- Type3
- Type5 – SSDC5.

Note *The E&M voice channels are always open, once timeslots for the voice have been allocated on the E1, even without the use of signaling.*

Selecting Coding law

Select this parameter to specify the compounding law to be used by the voice channels. The values are:

A Law Coding for E1 links

Specifying E signal from the E1 on

Select this parameter to specify the E signal receive mode from E1 into E&M. The values are:

A bit When the received A bit signal from E1 equals 1 then the E signal will be activated in the E&M interface
When the received A bit signal from E1 equals 0 then the E signal will be inactivated in the E&M interface

A bit inverted When the received A bit signal from E1 equals 0 then the E signal will be activated in the E&M interface
When the received A bit signal from E1 equals 1 then the E signal will be inactivated in the E&M interface

B bit When the received B bit signal from E1 equals 1 then the E signal will be activated in the E&M interface
When the received B bit signal from E1 equals 0 then the E signal will be inactivated in the E&M interface

B bit inverted When the received B bit signal from E1 equals 0 then the E signal will be activated in the E&M interface
When the received B bit signal from E1 equals 1 then the E signal will be inactivated in the E&M interface.

Specifying Default ABCD to the E1

This parameter specifies the default signaling bits that are not used for the M signal. Those bits will be transmitted towards E1.

Selecting Out of Service Method

This parameter specifies the *E signaling state in E&M* when an *Out of Service* condition is indicated in the E1 link. The values are:

Forced Idle E1 signal is held at *inactive* for the duration of the *Out of Service* condition

Forced Busy E1 signal is held at *active* for the duration of the *Out of Service* condition

Idle Busy E1 signal is held at *inactive* for 2.5 seconds, and then toggled to *active* until the *Out of Service* condition end

Busy Idle E1 signal is held at *active* for 2.5 seconds, and then toggled to *inactive* until the *Out of Service* condition end.

Mapping Timeslots for Voice Ports

Refer to *Table 5-19*.

A typical screen is shown in *Figure 5-60*.

```
E1 TIME SLOTS MAPPING: LINK1 ( Device name – FCD-IP )
---------------------
 TS1  [DATA LINK1]                      TS17 [NC]
 TS2  [DATA LINK1]                      TS18 [NC]
 TS3  [NC]    TS19 [NC]
 TS4  [NC]    TS20 [NC]
 TS5  [SUB1-VOICE]                      TS21 [NC]
 TS6  [SUB2-VOICE]                      TS22 [NC]
 TS7  [SUB1-DATA]                       TS23 [NC]
 TS8  [NC]    TS24 [NC]
 TS9  [NC]    TS25 [NC]
 TS10 [NC]    TS26 [NC]
 TS11 [NC]    TS27 [NC]
 TS12 [NC]    TS28 [NC]
 TS13 [NC]    TS29 [NC]
 TS14 [NC]    TS30 [NC]
 TS15 [NC]    TS31 [NC]
 TS16 [NC]

 Enter time slot number (0 refer to all time slots)
 Press 'ENTER' – to toggle the time slot type
 Press 'ESC' - to Return to previous menu
 Time slot number: 5
```

Figure 5-58. E1 Time Slots Mapping Link1 Screen

Advanced Setup Menu

Select this option to configure in-band management on E1/T1 links. The management is performed using a dedicated timeslot and can be enabled on the main link and Sub 1 (if it exists and has link capabilities). You can configurable which timeslot to use, and is the same for both links.

The management host IP is a unique address, different than the LAN or WAN IP addresses that may be configured elsewhere in the device. This IP address is used for SNMP, Telnet, TFTP downloads and Ping via the in-band management channel.

Note

- *In-band management links are established over PPP. Keep this in mind when connecting FCD-IP with another device, such as a Megaplex.*
- *RAD RIP proprietary routing protocol is used to dynamically learn and propagate management related routing information. Routing information learned from management links is not displayed in the general routing table, but in a dedicated screen, accessible from the View menu.*
- *Older versions of FCD-IP can be configured to periodically send a single-entry RIP-2 update about themselves, via their dedicated management timeslot. This enables other devices that are connected to them to learn their management IP address dynamically. Since RAD RIP is now implemented, there is no further need to support this option; however, for backward compatibility with older versions of FCD-IP, newer versions (4.00 and higher) are still capable of learning from these RIP-2 updates.*

➤ To access the Advanced Setup menu:

- Follow the screen path: **Main Menu > Advanced Setup > Setup > Interface Parameters > E1, T1, Voice Settings > Advanced Setup**

```
     ADVANCED SETUP  ( Device name - FCD-IP )

  1. Application mode                    : [Normal        ]
  2. Management LINK 1 status            : [Disable]
  3. Management SUB 1 status             : [Enable ]
  4. Management time slot number (RESET) : 1
  5. Management host IP address          : 1.2.3.4
  6. Management host MTU                 : 200
  7. Management learning ageing (minutes) : 5
  8. Recovery timeout (seconds)          : 12
  9. Management via INBAND LINKS         : [Enable ]
```

Figure 5-59. Advanced Setup Menu

Table 5-20. Advanced Setup Parameters

Parameters	Possible Values	Description
Application Mode	Normal	Normal mode is used when one E1/T1 only is needed (and for all older versions of FCD-IP)
	Chain	Chain mode adds an additional E1/T1 link, enabling traffic from Sub 1 as well as from the main link to be processed by the integrated router/bridge
	Ring	Ring mode is a RAD proprietary application that achieves immediate recovery in case of E1 failures. For full details refer to *Chapter 1*.
	Ring + Shared LAN	Ring + Shared LAN mode combines the second link option (used in Chain mode) to the Ring application ***Note:*** *Only values that are relevant to the hardware configuration of the current FCD-IP are displayed. For example, Ring is not displayed on T1 devices*

Parameters	Possible Values	Description
Management LINK 1 Status	Disable Enable	
Management Link 2 Status	Disable Enable	***Note:*** *This parameter is only available when it is possible to have link 2, depending on the hardware configuration.*
Management Time Slot Number (RESET)	1..31 (timeslot 16 is not available when a voice card exists)	The timeslot that will be dedicated for management traffic. The same timeslot is used for both management links (when both are enabled) ***Note:*** *The device will reset upon change of this parameter.*
Management Host IP Address	Valid IP address	IP address of the device that is used for all management traffic
Management Host MTU	100..1500	Management link Maximum Transmit Unit. The default is **200**, in order to be compatible with other RAD devices, for example, Megaplex
Management Learning Ageing (minutes)	0..9999	If no RAD RIP update (about a management routing entry) is received for this time period, the entry is removed from the management routing table 0 means up to 1 minute, 1 means up to 2 minutes, etc **Default: 5**
Recovery Timeout (seconds)	0..99	If a Ring link is down, FCD-IP will not try to reestablish it for the Recovery Timeout duration, even if it is synchronized on the E1 level. This prevents Ring multiple state changes in jittery lines 0 means immediate recovery ***Note:*** *This parameter is only available when Application Mode is Ring or Ring + Shared LAN.*
Management via Inband Links	Disable Enable	When enabled, SNMP traps and TFTP will go to the Inband Management link. When disabled, they will go to the other interfaces (for example, to the LAN).

Configuring the ISDN Interface

FCD-IP with ISDN connects your Ethernet LAN to the Internet/intranet at a rate of 64 or 128 kbps. FCD-IP with an ISDN interface was designed to reduce WAN costs to a minimum. WAN economy is achieved through automatic spoofing and connection-on-demand features for Internet/Intranet access.

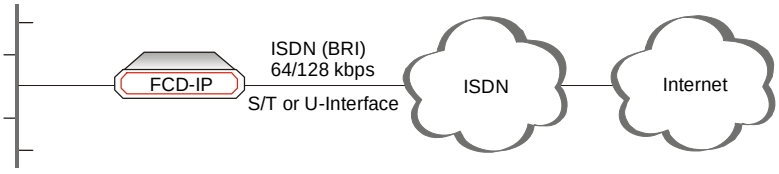


Figure 5-60. Connection to the Internet over ISDN

ISDN has the following features:

- ISDN BRI

- Standard S/T interface
- Optional U-interface eliminates the need for an external NT1 device
- Connection rate from 64 to 128 kbps
- Protocols supported: ETSI (Europe), NTT (Japan), NI-1 (U.S), 5ESS (U.S), DMS-100 (U.S), V1 and Leased ISDN (I.430).

➤ **To activate the ISDN line:**

1. Choose the ISDN protocol.
2. Choose the **Connection Rate** (bandwidth): 56 or 64 kbps.

The ISDN interface parameter has the following groups of sub parameters:

- Dialing mode parameters are shown in *Table 5-22*.
- Answering mode parameters are shown in *Table 5-23*.
- Local number for dialback parameters are shown in *Table 5-24*.

Table 5-21. Dialing Mode Parameters

Parameters	Description
Destination Phone Number	Select the phone number of the station you want to dial. This parameter is mandatory for dialing out. The other dialing mode parameters are optional.
Destination Sub-Number	Select the extension number of the destination phone number.
Source Phone Number	Select the phone number of the person dialing out. This parameter is used by the destination station to identify the caller.
Source Sub-Number	Select the extension number of the person dialing out.

Table 5-22. Answering Mode Parameters

Parameters	Description
Local Phone Number	Select this parameter to enter the number to which incoming calls are directed.
Local Sub-Number	Select this parameter to enter the extension to which incoming calls are directed.

Table 5-23. Local Number for Dialback

Parameters	Description
Dialback Phone Number	Select this parameter to enter the phone number which is used by the ISP to dial back FCD-IP. When FCD-IP wants to dial-up to the ISP, the ISP uses this number to identify and dial back FCD-IP (similar to reverse charging). In this way, the PTT bills the ISP and not the caller. This feature is only useful when dialback is enabled on both sides.
Dialback Sub-Number	Select this parameter to enter the extension used by the ISP for dialback purposes.

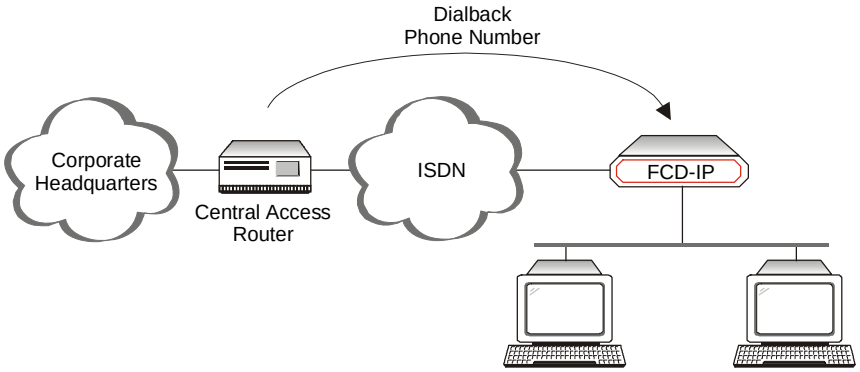


Figure 5-61. Dialback Phone Number

Configuring the Frame Relay Interface

➤ To access the Frame Relay DLCI Settings screen:

- Follow the screen path: **Main Menu › Advanced Setup › Setup › Interface Parameters › Frame Relay DCLI Settings › DCLI**

```
 FRAME RELAY DLCI SETTINGS  ( Device name - 27 )
 -------------------------
 LINK       DLCI   STATE       CIR        EXCESS    THROUGHPUT
----------  ----  --------  ----------  ----------  ----------


A - Add, E - Edit, D - Delete, C - Clear all
ESC - Return to previous menu

Choose one of the above:
```

Figure 5-62. Frame Relay DLCI Settings

Frame Relay is a form of WAN that is designed to maximize throughput and minimize cost by simplifying network processing.

Figure 5-65 shows the connection of FCD-IP to Internet/Intranet through Frame Relay network.

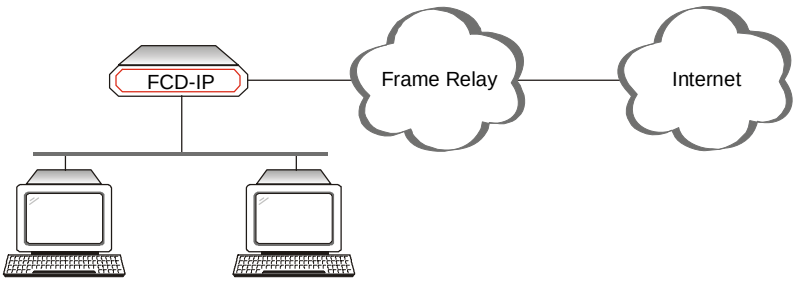


Figure 5-63. Connection to the Internet over Frame Relay

Frame Relay:

- Supports permanent virtual circuits (PVC)

- Supports Frame Relay (IP/IPX/Bridge) encapsulation based on RFC 1490
- Supports different maintenance protocols:
  - T1.617/ANNEX D
  - Q.933/ANNEX A
  - LMI
- Supports self-learning of the maintenance protocol and the DLCI which enables connection to the Frame Relay network without configuring Frame Relay parameters
- Executes congestion control when an explicit congestion notification is received for the DLCI from the Frame Relay network. The unit reduces the transmitted information rate of the DLCI and increases it when the congestion condition is cleared.
- Supports the Frame Relay SNMP MIB.

Implementing Frame Relay

The diagram below maps the options in the Advanced Menu which are used to configure FCD-IP for operation over a Frame Relay network.

The parameters in the Frame Relay Links Parameters menu are described in *Table 5-25*.

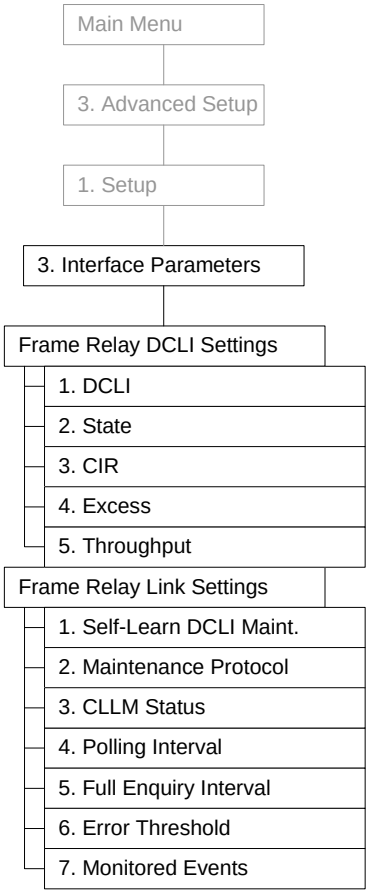


Figure 5-64. Frame Relay Options in the Advanced Menu

Table 5-24. Frame Relay Link Parameters

Parameters	Description
Self Learn DLCI/Maintenance	Specifies whether FCD-IP will self learn the maintenance protocol on the Frame Relay link and the existing DLCIs with their status (UP or DOWN). When this parameter is disabled (OFF), you need to configure the maintenance protocol and the DLCIs manually.
CLLM Status	Specifies whether CLLM frames, used for congestion indication, will be supported (**ON**) or not (**OFF**).
Maintenance Protocol	Specifies the maintenance protocol of the Frame Relay link: **T1.617/ANNEX D, Q.933/ANNEX A, LMI** or **None**. This parameter can only be configured if Self learn DLCI /Maintenance parameter is disabled (**OFF**).
Polling Interval	Specifies the number of seconds between transmission of two successive status enquiry frames.
Full Enquiry Interval	Specifies the number of polling intervals after which a full status request frame is transmitted.
Error Threshold	Specifies the number of unacknowledged monitored events (status enquiry frames and full status enquiry frames) that can occur in a sliding monitored events window before the link is declared DOWN.
Monitored Events	Specifies the number of monitored events (status enquiry frames and full status enquiry frames) in a sliding monitored events window.

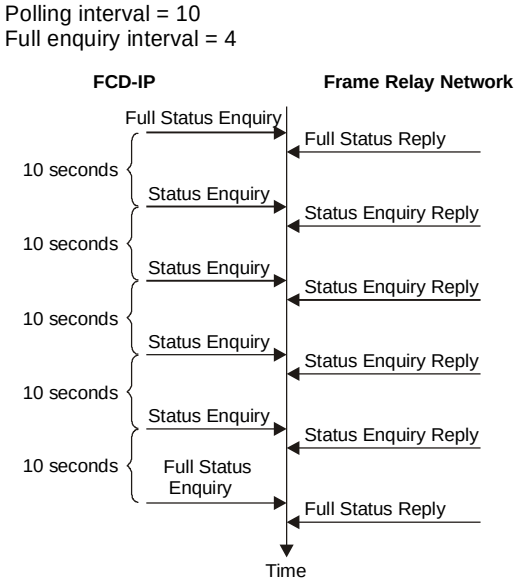


Figure 5-65. Polling Intervals

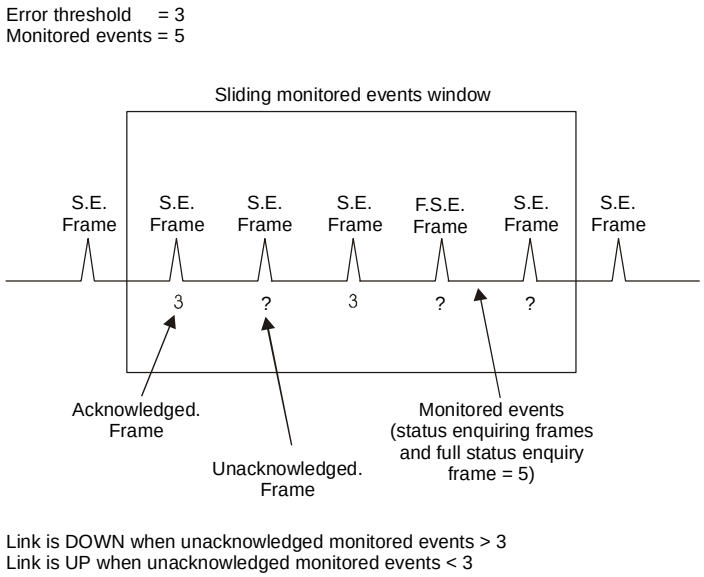


Figure 5-66. Monitored Events

After the link is declared DOWN, it can only be declared UP again when the sliding monitored events window contains only successfully monitored events.

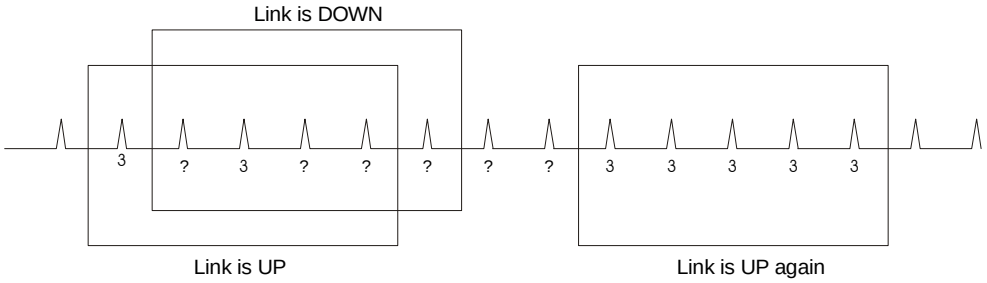


Figure 5-67. Monitored Events - Down Link

Frame Relay DLCI Parameters

Table 5-25. Frame Relay DLCI Parameters

Parameters	Possible Values	Description
DLCI	16 to 991	Specifies the DLCI number
State	Enabled Disabled	Specifies the DLCI state
CIR	The value of this parameter is obtained from the Frame Relay provider.	Specifies the maximum amount of data (in bits) which the network guarantees to transfer during the measurement interval (the measurement interval is usually one second)

Table 5-25. Frame Relay DLCI Parameters (Cont.)

Parameters	Possible Values	Description
Excess	The value of this parameter should be received from the Frame Relay provider.	Specifies the maximum amount of uncommitted data bits that the network will attempt to deliver during the measurement interval
Throughput		Specifies the average number of data bits per second transferred by the network. When a measurement interval of one second is assigned to the CIR, the throughput value should equal the CIR value.

5.9 Configuring Access Control (Security)

Select this option to configure access to FCD-IP.

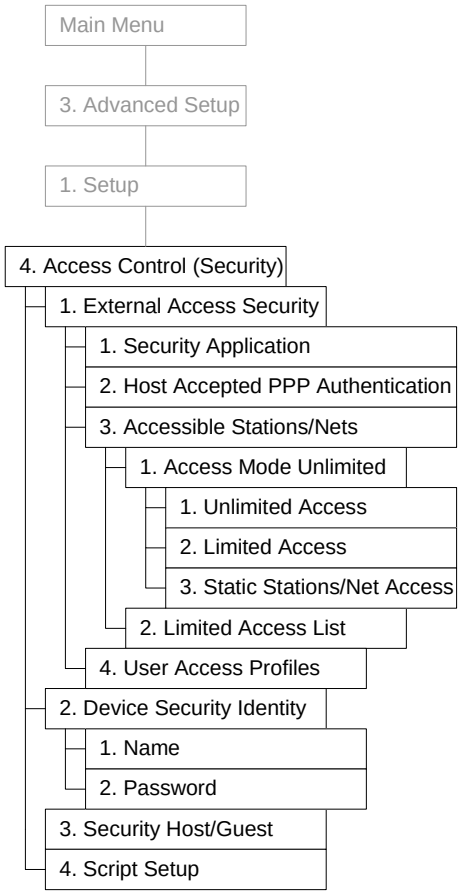


Figure 5-68. Access Control Menu Outline

➤ **To access the Access Control menu:**

- Follow the screen path: **Main Menu > Advanced Setup > Setup > Access Control (Security)**

```
            ACCESS CONTROL ( Device name - FCD-IP )
                        --------------

1. External access security
2. Device security identity
3. Security Host/Guest
4. Script Setup

ESC - Return to previous menu

Choose one of the above:
```

Figure 5-69. Access Control Menu

The options in the Access Control menu are described below.

Defining External Access Security (only Relevant to Link with PPP Protocol)

➤ To access the External Access Security menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Access Control (Security) > External Access Security

```
     EXTERNAL ACCESS SECURITY  ( Device name - FCD-IP )
     ------------------------
  1.  Security authentication: [None]
  2.  Host accepted PPP authentication
  3.  Accessible stations/nets
  4.  User access profiles
  ESC - Return to previous menu

  Choose one of the above:
```

Figure 5-70. External Access Security Menu

Table 5-26. External Access Security Parameters

Parameters	Possible Values	Description
Security Authentication		Protects your LAN against unwanted entry by outside users.
	None	Access permitted to all users.
	User Access Profile	Allow/deny access according to the User Access Profile (see below).
	RADIUS	Allow/deny access according to the RADIUS Authenticator.
	User Access Profile+RADIUS	Access is allowed if the User Access Profile permits it OR if the User Access Profile does not have an entry for the user but the RADIUS Authenticator allows it.
		***Note**: If you select RADIUS, configure the RADIUS Access parameters from the Host Parameters Menu. Refer to RADIUS Authentication and Billing.*
Accepted PPP Authentication (only relevant to Link with PPP Protocol)		PPP supports two types of security systems:
	CHAP (Challenge Handshake Authentication Protocol)	CHAP is a type of authentication in which the authentication agent (typically a network server) sends the client program a key to be used to encrypt the username and password. This enables the username and password to be transmitted in an encrypted form to protect them against hackers.
	PAP (Password Authentication Protocol)	PAP is the most basic form of authentication, in which a user's name and password are transmitted over a network and compared to a table of name-password pairs. Typically, the passwords stored in the table are encrypted. The main weakness of PAP is that both the username and password are transmitted in an unencrypted form.
Accessible Stations/Nets		Defines parameters which limit public access to the network. Access can be allowed for all stations/nets, only certain stations/nets, or only stations/nets which are static. When the access mode is 'limited', use the access list to define which stations/nets have access.
User Access Profiles (only relevant to Link with PPP Protocol)		View and modify user access profiles in the access control users list. The list contains user names, security parameters and dialback options.

Defining Device Security Identity (PPP only)

➤ To access the Device Security Identity menu:

- Follow the screen path: **Main Menu > Advanced Setup > Setup > Access Control (Security) > Device Security Identity**

```
      DEVICE SECURITY IDENTITY  ( Device name – FCD-IP )

  1. Name    : FCD IP
  2. Password:
 Press the number to edit value or ESC to return to the previous screen:
```

Figure 5-71. Device Security Identity Menu

Table 5-27. Device Security Identity

Parameters	Description
Name	Assigns a name to FCD-IP for access to the ISP central access router. The maximum length is 30 characters.
Password	Assigns a password to FCD-IP for access to the ISP central access router. The maximum length is 30 characters.

Configuring Security Host/Guest (PPP only)

➤ To access the Security Host/Guest menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Access Control (Security) > Security Host/Guest

```
SECURITY HOST/GUEST  ( Device name - FCD-IP )

  1. Security for LINK 1    : [HOST ]
  2. Security for LINK 2    : [HOST ]

 Press the number to edit value or ESC to return to the previous screen:
```

Figure 5-72. Security Host/Guest Menu

Select this parameter to define a link's security status. When a link is defined as a Host, users are approved according to your profile list. When the link is defined as a Guest, the device sends its name and password (defined above) to be approved by the host. The Guest mode is the default for *Originate only* links. For *Answer* and *Answer&Originate* links the default mode is Host.

Defining Login Script

➤ To access the Script Setup menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Access Control (Security) > Script Setup

```
     CURRENT SCRIPT FOR LINK 1                    Status: [disable]
     -------------------------                    -------

A - Append, I - Insert, D - Delete, E - Edit, C - Clear all
N - Next screen, P - Previous screen, S - Status change
ESC - return to previous menu
Choose one of the above:
```

Figure 5-73. Script Setup Menu

The FCD-IP scripting tool allows you to negotiate an initial login, required by some ISPs. The initial login usually consists of a username, password and possibly additional information which has to be entered to gain access to the ISP.

FCD-IP script is a sequence of commands, with a maximum of 20 commands in the script. As soon as a physical connection to the remote host is achieved (and the script is enabled), FCD-IP begins to forward the script. Script processing finishes when the last script command has been forwarded.

FCD-IP script comprises one or more command lines. Each command line consists of a *Command Code* followed by an *Argument*.

Configuring Command Code

The command codes are described in *Table 5-29*.

Table 5-28. Command Codes

Command Code	Description
waitcase pattern	Waits until the specified case-sensitive pattern is received from the remote host and forwards the next command. The maximum pattern length is 24 characters. Or, waits until timeout (default = **15 seconds**). The link then disconnects and FCD-IP performs the same actions as required during authentication failure.
waitnocase pattern	Same as waitcase *pattern* except not case sensitive.
send pattern	Transmits specified pattern to remote host. The pattern can contain any recognized control symbols. The maximum pattern length is 24 characters.
sendhide pattern	As above. However, the pattern is displayed on the screen as asterisks. The control symbol is displayed as two asterisks when editing and as one when viewing.
timeout number	Changes the timeout for waitcase, waitnocase and getip commands. The number is the timeout value, in seconds. This value can be any number from 1 to 99 and will be used until the next timeout command.
delay number	The delay in seconds between sending commands. All symbols received during this time will be ignored. This value can be any number from 1 to 99.
getip number	This command waits for an IP address from the remote host. If the remote host returns several IP addresses in a string, the number specified by this command will determine which IP address should be used. If an IP address is received successfully from the host, and the Single IP feature is enabled, the IP address will be used on FCD-IP WAN interface. If an IP address is not received successfully within the specified timeout period, the link disconnects.

Defining Argument

The argument is any string without apostrophes, quotation marks or unsigned integers (depending on the command). In addition to ASCII symbols, the argument string can include any control characters with ASCII codes from 1 to 31. While editing scripting commands, these symbols are entered in the 'control' mode i.e. each symbol is entered as "^", followed by the corresponding ASCII character from "A" to "[". The letters must be in upper case. Refer to *Table 5-30*.

Table 5-29. Example of Argument

Code to wait/send	Control Sequence
0x0A (line feed)	^J
0x0D (carriage return)	^M
0x0B (escape)	^[

5.10 Configuring WAN Economy

Select this option to reduce traffic over the WAN and to keep the link up only when necessary

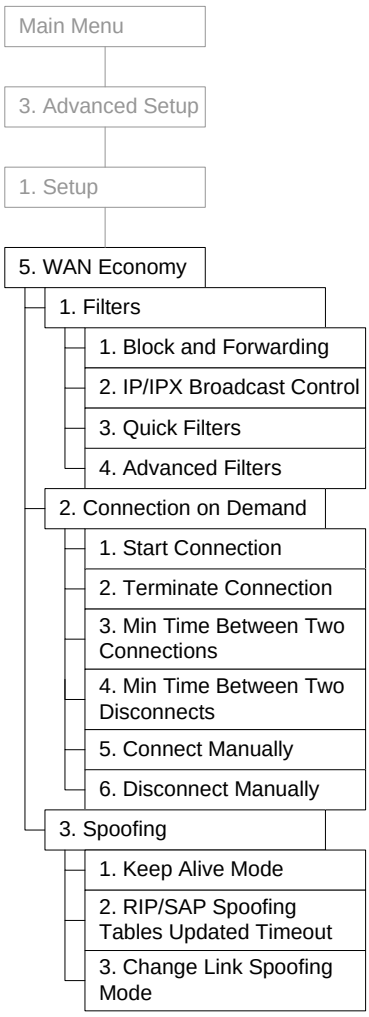


Figure 5-74. WAN Economy Menu Outline

➤ To access the WAN Economy menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > WAN Economy

```
WAN ECONOMY ( Device name - FCD-IP )
-----------
Use these features:
- to reduce traffic over the WAN to a minimum and increase throughput
- to keep the link up only when it is required

1. Filters
2. Connection on demand
3. Spoofing

ESC - Return to previous menu
Choose one of the above:
```

Figure 5-75. WAN Economy Menu

The options in the WAN Economy menu are described below.

Defining Filters

Filtering allows you to limit the amount of traffic that enters and exits the Small Office LAN via FCD-IP. If FCD-IP is attached to more than one LAN, then select this option for each LAN interface. Filtering is used to:

- Increase security
- Reduce traffic to the link.

FCD-IP features two types of filters:

- Quick Filters
- Advanced Filters.

Quick Filters are used to regulate specific protocols:

- IP
- IPX
- SNA
- NetBIOS
- AppleTalk
- DECnet.
- Others.

A Quick Filter can neutralize these protocols by blocking all traffic of that protocol from the LINK inwards. Refer to *Figure 5-78*.

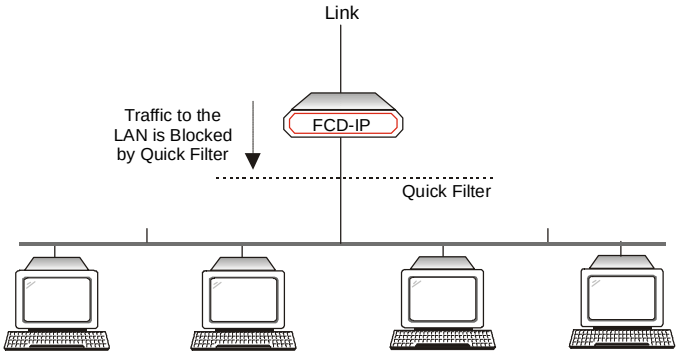


Figure 5-76. Action of a Quick Filter

Advanced Filters are used to regulate traffic in both directions. (Refer to *Figure 5-79*).

- From LAN to the Link. Using filters here will forward or block traffic from the LAN outwards.
- From Link to the LAN. Using filters here will forward or block traffic from the link inwards.

Using a variety of parameters, Advanced Filters can be used to regulate different protocols, to totally or partially block traffic, and to control traffic between links.

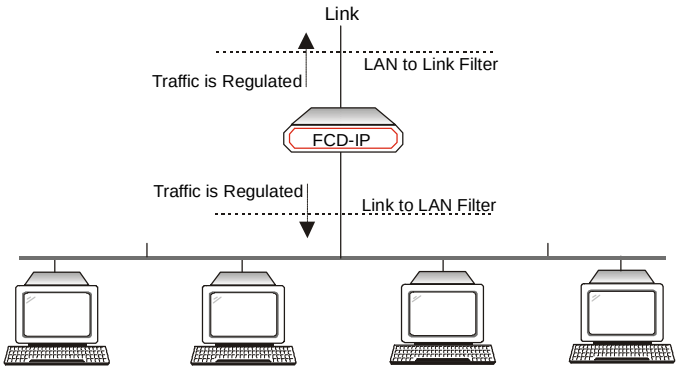


Figure 5-77. Action of an Advanced Filter

There are two modes through which filtering can be implemented: blocking and forwarding.

Blocking

The block command causes FCD-IP to test every packet of data that is sent to or from the LAN. If the packet passes the test, passage is denied.

Example:

You want to ensure that IP/UDP packets do not go on to the link in the direction of the Internet/Intranet. Thus, you design a filter, which tests each packet to see if it is an IP/UDP packet. If the packet tests positive, it is automatically blocked.

Forwarding

The forward command works in the same way as the block command. However, with forwarding, if the packet passes the test, the packet is allowed to pass to or from the LAN.

Example:

To allow a certain user on the Small Office LAN to access the Internet for FTP purposes, create a filter to test each packet for the IP host address of the specified user and the FTP socket of the packet. If the packet passes the test, the packet is forwarded to the Internet/Intranet.

Setting Multiple Filters

Up to 18 filters can be defined. If there are 2 filters that have contradictory operations, forwarding takes precedence over blocking.

Example:

You want to allow only one particular user on the Small Office LAN to access the Internet for FTP purposes. To insure that no one else is able to access the Internet, create a blocking filter for all traffic going to the link. To do this, from the Blocking and Forwarding menu enter Block all traffic for Link1. In addition, create a filter to test each packet for the IP host address of the specified user and the FTP socket of the packet. Since forwarding takes precedence over blocking, that user's frames are forwarded.

Definition of Filter Tests

You need to define the filter test which will be applied to every packet that is transmitted. Use any combination of the following parameters to define the filter test:

- Protocol
- Operation (block, forward, etc.)
- Interface (LAN, Link)
- Destination and/or source IP address of the packet
- Destination and/or source MAC address of the packet (layer 2)
- IP socket (upper and lower level)
- IP packet type (broadcast, multicast).

Note *Up to 18 filters can be defined. To avoid reducing FCD-IP performance, minimize the number of active filters.*

Defining Filters

Filters can be defined through the control port, TELNET or SNMP. First decide on the mode and conditions for a filter, then follow the instructions below to set filter parameters.

Note *Remember that forwarding takes precedence over blocking. If there is a combination of filters which contain both operations, the frame will be forwarded.*

Setting Quick Filters

➤ To access the Filters menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > WAN Economy > Filters

```
FILTERS ( Device name - FCD-IP )

 1. Block and Forwarding
 2. IP / IPX broadcast control - [Full Propagation]
 3. Quick filters
 4. Advanced filters


 Esc - Return to main menu

 Choose one of the above:
```

Figure 5-78. Filters Menu

➤ **To configure the operation:**

1. From the Filters menu, choose Block and Forwarding.
2. Toggle between **Block** and **Forward**.

➤ **To configure the broadcast control:**

The broadcast control filter manages special frames, normally not propagated throughout the network. The frames managed are:

- IP – Local broadcast propagation
- IPX – Zero destination propagation, IPX Type 20 frames propagation
- NETBIOS over IP – IP frames with TCP/UDP ports 137, 138, 139 propagation.

From the Filters menu, press **2** to toggle between Full Propagation and Block Propagation.

Factory default: Block Propagation.

Quick Filters are defined per protocol. Configure each protocol that you want to block or forward.

➤ **To configure the Quick Filter parameters:**

1. From the Filters menu, choose Quick Filters.

   Follow the screen path: **Main Menu › Advanced Setup › Setup › WAN Economy › Filters › Quick Filters**

2. To toggle between Forward/Block, press the number of the protocol that you want to filter.

```
QUICK  FILTERS ( Device name - FCD-IP )
 Choose the protocols you want to block or forward!!:
 (The Blocking or forwarding is to interface LAN 1 only)

 1. IP          NO FILTERS
 2. IPX         NO FILTERS
 3. SNA         NO FILTERS
 4. NetBIOS     NO FILTERS
 5. AppleTalk   NO FILTERS
 6. DECnet      NO FILTERS
 7. Others      NO FILTERS

 ESC - Return to previous menu
 Choose one of the above:
```

Figure 5-79. Quick Filters Menu

Note *In FCD-IP 2 LANs configuration:*
For LAN1, use Quick Filters
For LAN2, use Advanced Filter.

Setting Advanced Filters

There are 4 steps in defining an Advanced Filter:

1. Follow the screen path: **Main Menu > Advanced Setup > Setup > WAN Economy > Filters**
2. Choose **Advanced Filter**.
3. If you are defining a new filter, choose **Add**.

   If you are editing a filter, choose **Edit** and enter the filter number.
4. Define the desired parameters.

Advanced Filter Concepts

When defining an advanced filter the following parameters must be determined:

- Filter ID - A selection number used to view, edit or delete a particular file. To work with any filter, the Filter ID number must be entered.

Adding Filters

```
ADD  FILTERS ( Device name - FCD-IP )

ENTER     -  Enter data
SPACE     -  Toggle (parameters inside [] )
N         -  Next line (skip this one)
SPACE     -  Move right
BACKSPACE -  Move left
ESC       -  Return to previous menu

Filter Id -  1
```

Figure 5-80. Add Filters Menu

Table 5-31 lists the terms used in the filters menu.

Table 5-30. Add Filters Menu Terms

Terms	Description
Protocol	Protocol on which the filter operates
Operation	Action of the filter
Interface	Filter interface
Source Address	Source address of passing frames
Destination Address	Destination address of passing frames
High level (IP only)	Includes or excludes high-level protocols
Source/Destination Port	Port source/destination address of an application
Source/Destination Socket	Socket source/destination address of an application
Low Level	Includes or excludes the low level protocols

Terms	Description
Mask	Mask filter
Status	Filter's status

True-False Menus

Many of the Advanced Filter parameters can be configured so that:

- Frames with that parameter pass (true)
- Frames without that parameter pass (false).

For example, if you choose BroadCast-True, any frame which is BroadCast will pass. If you choose BroadCast-False, any frame which is not BroadCast will pass.

Advanced Filter Parameters

Table 5-31. Advanced Filter Parameters

Parameter	Possible Values	Description
Filter ID		System automatically assigns a new number to each filter
Protocol		Protocol on which the filter operates
Operation	Forward Block Connect Disconnect	Action which the filter applies to a frame that passes The operations are listed in their order of priority. For example if the connect and disconnect commands are applied to a frame, the connect command takes precedence. ***Note:*** *Connect and disconnect are only relevant to Connection on Demand. When accessed through the Filter menu, only they appear.*
Interface		Area where the filters will act. If you want to filter traffic going to the LAN, choose LAN. If you want to filter traffic going to the link, choose Link.
Source Address		Toggle to the desired address type (**MAC** or **NET**). The address format (hexadecimal or binary) appears. Type in the complete source address. If you want to include a group of addresses, type <x> to indicate "Don't care". For example, a filter with the MAC source address the 4020.D2FE.xxxx will pass any address beginning with 4020.D2FE. You select IP RANGE to filter a group of sequential IP addresses.
Destination Address	MAC NET All BroadCast MultiCast	Toggle to the desired address type. The address format (hexadecimal or binary) appears. Type in the complete destination address. Choose True or False. Normally, a frame has a particular destination, as specified in the destination address field of the frame. Such frames are referred to as "All" frames. "BroadCast" frames are intended for all stations. If you specify "BroadCast" do not specify a mask pattern. Select IP RANGE to filter a group of sequential IP addresses.

Parameter	Possible Values	Description
High Level	Yes, No	When you choose this parameter, 2 choices appear:**Yes** and **No**. When **Yes** is chosen, a list of High Level protocols appear. The High Level protocols include: **FTP** **WWW** **TELNET** **E-MAIL** **TFTP** **SNMP** **DNS** **RIP.** Choose **True** or **False** for each protocol to be filtered.
Source/ Destination Sockets		This parameter differs for IP and IPX. **IP** – The Destination Port is enabled when no High Level protocol is specified. If you define a port number in decimal numbers, define the low level protocol as **UTP** or **TCP**. If no port number is defined, define the low level protocol as **UTP, TCP**, or **ICMP**. Choose **True** or **False** **IPX** – If a socket address or low level protocol is not defined, a socket number may be specified. Choose **True** or **False**.
Low Level (IP protocol)	UTP TCP ICMP	Toggle to the required low level protocol for the filter. If the port number is defined in decimal format, specify the low level protocol as **UTP** or **TCP**. If no port number is defined, specify the low level protocol as **UTP, TCP**, or **ICMP**. Choose **True** or **False**.
Low Level (IPX protocol)		Toggle to the required low level protocol for the filter. If a socket is defined in the destination address, a low level protocol or socket number may not be specified. Conversely, if a socket address or low level is not defined, a socket number may be specified.
Mask		A mask is a test pattern that is used to allow certain frame patterns only. You define a code against which the frame is compared. To create a mask, toggle to **Yes**. Three pairs of codes and offsets must be created. The offset defines the point in the frame at which the comparison is made. For example, an offset of 8 means that the 8th byte is compared to the code. The offset can be from the 7th byte onwards. The frame is made of 3 different portions: **MAC** - is at the beginning of the frame **LLC** - is after the source address in the frame **DATA** - is after the LLC section in the frame. For each code-offset pair, select the code format: **Binary** - specify 48 address bits to be either 0,1, or X (unspecified) **Hexadecimal** - specify 12 hex digits to be 0-F or X (unspecified). For each code-offset pair, choose **True** or **False**. Every frame, at the designated offsets, is compared to the three codes in the mask. If all three codes and the True-False condition match the code written in the frame, the frame passes. ***Note**: Only one mask can be defined.*

Parameter	Possible Values	Description
Status	Active	The filter is in use.
	Not Active	Allows you to define filters which can be stored and used at a later time.

Saving Filter Parameters

All filters are stored in the Flash Memory, thereby preserving them if the power goes down. When filtering is selected, all of the filters are copied into the RAM. The RAM copy is then used to activate the software filtering process. Any filter which is modified, (by clearing all, deleting one, or changing a parameter) goes into effect immediately. The previous filter also remains in effect until the system is rebooted.

To exit filtering and return to the main Setup menu, press <**Esc**>. The following prompt appears: 'up' `(Y/N)?`

Press **Y** to save changes in the Flash Memory. Press **N** to cancel your changes. The system loads the previous set of masks the next time the system is rebooted.

Configuring Connection on Demand

➤ **To access the Connection On Demand menu:**

- Follow the screen path: **Main Menu > Advanced Setup > Setup > WAN Economy > Connection On Demand**

```
Connection On Demand ( Device name - FCD-IP )
-------------------
 1. Start Connection
 2. Terminate Connection
 3. Minimum Time Between Two Connects
 4. Minimum Time Between Two Disconnects
 5. Connect Manually
 6. Disconnect Manually

 ESC - Return to previous menu
 Choose one of the above:
```

Figure 5-81. Connection On Demand Menu

To save money, you may want to limit the time that a link is kept open. COD allows you to determine the traffic conditions that open and close the link. Using COD, a line is opened only when traffic conditions fulfill specified conditions. When there is no need for a connection, the line is automatically terminated.

COD is only effective if:

- The line is connected to a modem or ISDN (a dialup link)
- The link is asynchronous
- The connection type is *Originate* or *Answer&Originate*.

If the connection type is *Answer only*, the line connection is started when the unit is turned on in order to receive calls. If the connection type is *Originate only* or *Answer&Originate* the connection starts when a telephone number is defined.

You need to configure:

- Start Connection
- Terminate Connection.

Table 5-32. Connection On Demand Parameters

Parameters	Possible Values	Description
Start Connection		Start Connection is used to determine under which conditions is a line established. To use this function, the line *must not* be designated as *answer only*. After a physical connection is made, data is transferred.
	Upon Power Up	The line is established when the unit is turned on. Upon Power Up is recommended for leased lines only
	Any Frame to Forward	The line is established when any frame that is directed to the link arrives
	Specific Frame to Forward	The line is established only when specific types of frames directed to the link arrive. To determine which frames establish a line, filters are used to specify the type of frame. Any number of filters can be used. Filters work as a Boolean "OR"; by specifying a filter for frame type A and filter for frame type B, you establish a line for Frame type A or Frame type B. Choosing this option automatically opens the Advanced Filter menu, with *Connect Operation* selected
	Never	The line is permanently cutoff. In this case, you manually decide when to activate a line.
Terminate Connection		Terminate Connection is used to determine under which conditions does a link terminates. Termination takes place only after a physical connection is made.
	Never	The line is never terminated. **Never** is usually used when **Upon Power Up** is used
	No Frame to Forward	The line is terminated after a specified time passes without a frame passing through the line. You specify the time in which a frame must pass. The default is 60 seconds
	Upon Time Out	The line is terminated after a fixed period of time regardless of the traffic. The default is 60 seconds
	No Specific Frame to Forward	The line is terminated if traffic of a specific type of frame falls below a certain rate over a period of time. You determine the number of frames and the time period in which they must pass. Using filters, you specify which type of frames are counted. If frames other than those specified pass through, they are not counted. Choosing this option automatically opens the Advanced Filter menu

Parameters	Possible Values	Description
Minimum Time Between 2 Connections		Determines how much time there must be between a line being terminated and then reactivated. This option is only used when *upon power up* is chosen in *start connection*. All other options are determined by the frame traffic
Minimum Time Between 2 Disconnections		Determines the minimum time between two disconnections. Using this option allows you to determine a minimum time-up. This option overrides other *terminate connection* options
Connect Manually		Activates a line immediately. This option overrides any other connection option, including *minimum time between 2 connections*
Disconnect Manually		Terminates a line immediately. This option overrides any other terminate option, *including minimum time between 2 disconnections*

The following examples demonstrate how COD can be used.

Example 1:

A company needs their FCD-IP to be connected to the Internet 24 hours a day. Therefore the following must be defined:

Start connection is *upon power up*

Terminate Connection is *never* (see *Figure 5-84*).

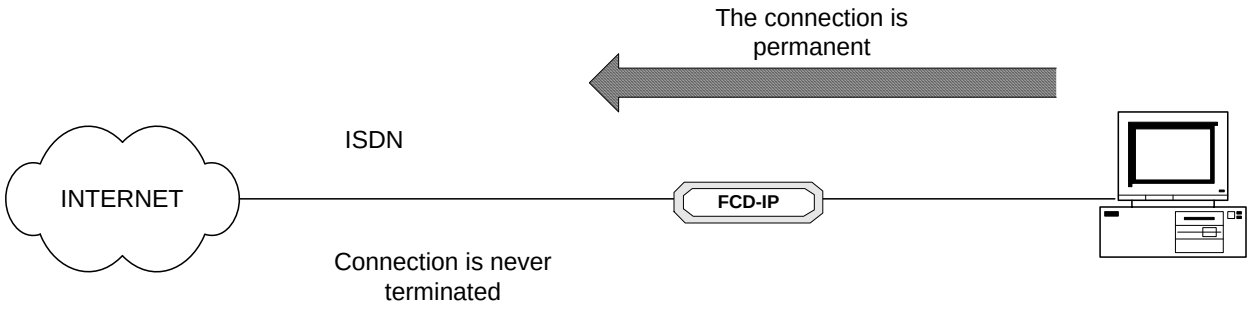


Figure 5-82. Permanent Connection

Example 2:

To lower expenses, FCD-IP is configured so that a line to the Internet is activated when there is a need to connect to the Internet and terminates when no frames are transmitted for 60 seconds. Therefore the following must be defined:

- Start Connection is any frame to forward
- Terminate Connection is no frame to forward for 60 seconds (see *Figure 5-85*).

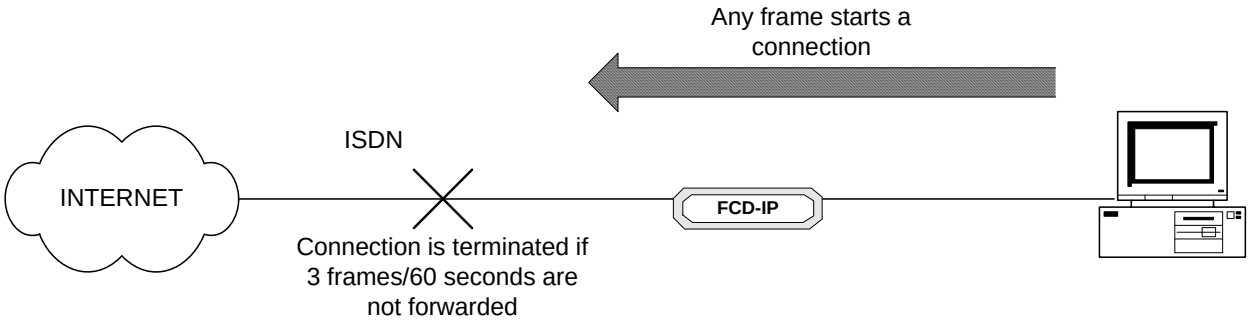


Figure 5-83. Any Frame Starts a Connection

Example 3:

The company management wants to allow the PC with the IP address 1.2.3.4 only access to the Internet. In addition, the connection to the Internet is to be terminated if 3 frames every 60 seconds are not transmitted from this PC.

Therefore the following must be defined:

- Start connection must be *specific frame to forward*. A filter which allows only frames from the 1.2.3.4 IP address must be defined.
- Terminate connection must be *no specific frame to forward*. A filter which counts only frames from the 1.2.3.4 IP address must be defined. In addition the rate must be defined at 3 frames/60 seconds (see *Figure 5-86*).

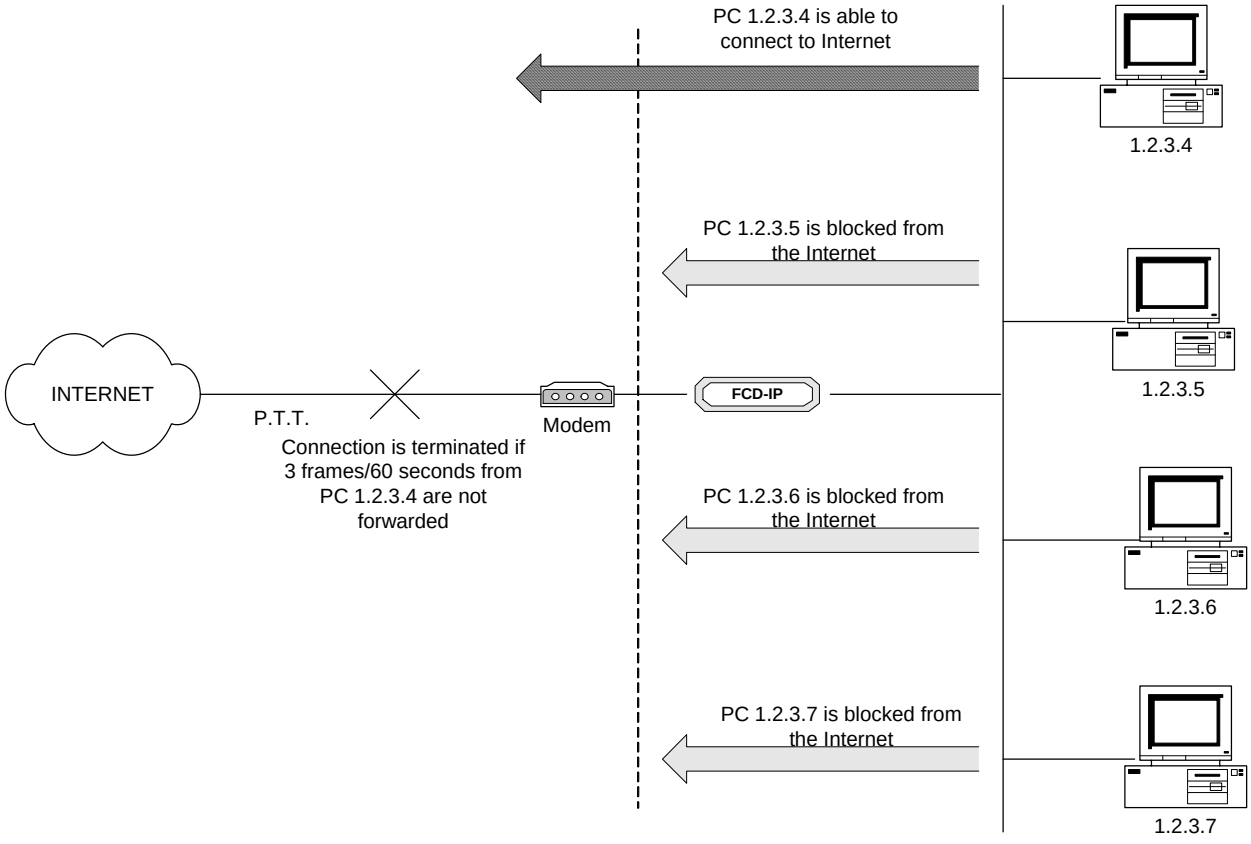


Figure 5-84. Limiting Access to a Specific PC

Example 4:

A company uses a phone line which uses a phone and modem to connect to the Internet. The only time that the employees may connect to the Internet is if they need to upload or download files to a FTP site. Any connection to the Internet is to be done manually. After the file has been uploaded or downloaded the connection is to be terminated automatically. Therefore the following must be defined:

- Start connection must be *never*. Any time someone wants to connect, the user must connect manually.
- Terminate connection must be *upon time out*. The time is set to 30 seconds.
- Set filter to *FTP only forwarded* (see *Figure 5-87*).

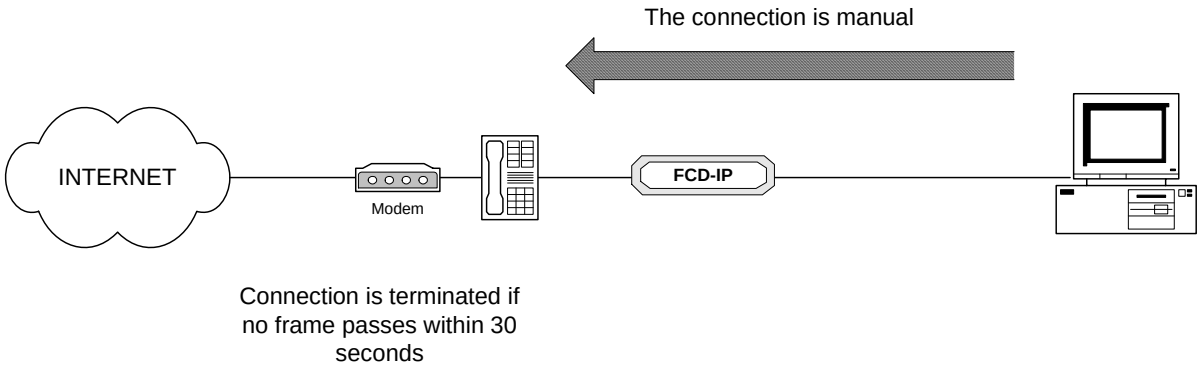


Figure 5-85. Manual Connection

Defining Spoofing

Spoofing is a technique used to reduce network overhead, especially in wide area networks (WAN). Some network protocols send frequent packets for management purposes. These can be routing updates or keep-alive messages. In a WAN this can introduce significant overhead, due to the typically smaller bandwidth of WAN connections.
Spoofing reduces the required bandwidth by having devices, such as bridges or routers, answer for the remote devices. This fools (spoofs) the LAN device into thinking that the remote LAN is still connected, even though it is not. The spoofing saves the WAN bandwidth, because no packet is ever sent out on the WAN.

➤ **To access the IP/IPX Spoofing menu:**

- Follow the screen path: **Main Menu > Advanced Setup > Setup > WAN Economy > Spoofing**

```
  IP/IPX SPOOFING  ( Device name – FCD-IP )
  ---------------
Keep Alive (IPX)
----------------
1.  Keep Alive mode: [Disabled]

RIP / SAP spoofing (IP/IPX)
---------------------------
2.  RIP/SAP spoofing tables updated timeout (minutes): 30
3.  Change link spoofing mode
  Link 1 spoofing mode: Disabled
  Link 2 spoofing mode: Disabled

ESC - Return to previous menu
Choose one of the above:
```

Figure 5-86. IP/IPX Spoofing Menu

Configure the following parameters for the Spoofing Menu.

Table 5-33. IP/IPX Spoofing Parameters

Parameters	Possible Values	Description
Keep Alive (IPX)	Enable Disable	Enables/Disables the Keep Alive mode. Keep Alive mode allows the remote user to remain on the local server station list for a specified period of time during link disconnection ***Note**: SPX spoofing is not supported.*
RIP/SAP Spoofing (IP/IPX)		Spoofing is a technique used to reduce network overhead, especially in a WAN. Some network protocols send frequent packets for management purposes. These can be routing updates or keep-alive messages. In a WAN this can introduce significant overhead, due to the typically smaller bandwidth of WAN connections. Select this parameter to determine the length of time (in minutes) between exchange of RIP and IPX SAP tables over the WAN. This parameter is applicable unless spoofing mode is set to "Upon Change" only.

Parameters	Possible Values	Description
Change Link Spoofing Mode	Disabled (default)	When disabled, RIP/SAP updates are sent: • After a defined time (default time is **30 seconds** IP, **60 seconds** IPX RIP and SAP) • When there is a change in the network topology; for example an interface goes up or down, or a routing entry aged
	Enabled	When enabled, RIP/SAP updates are sent: • After a defined time • When there is a change in the network topology • After a defined time and a change in network topology
	Enabled COD	When this parameter is set to Enabled COD, updates are sent according to: • The disabled parameter when the line is up. • The enabled parameter when the line down.

5.11 Resetting FCD-IP to the Defaults

The Factory Default menu allows you to change all configuration parameters, returning configuration parameters back to their factory defaults.

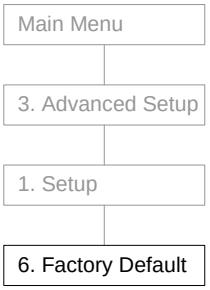


Figure 5-87. Factory Default Menu Outline

➤ **To access the Factory Default menu:**

1. In the **Advanced Setup** menu, press **Setup**.

   The Setup menu appears.

2. From the **Setup** menu, press **Factory Default**.
3. Type **Yes** to reset the parameters to the factory default. Press any other key if you do not want to reset.

Chapter 6

Configuring FCD-IP for a Typical Application

This chapter provides detailed instructions for setting up a typical application with FCD-IP.

6.1 Overview

Application

The section provides detailed instructions for configuring FCD-IP unit with a sub-E1 and 10/100BaseT LAN interface, operating in the IP router mode (see *Figure 6-1*).

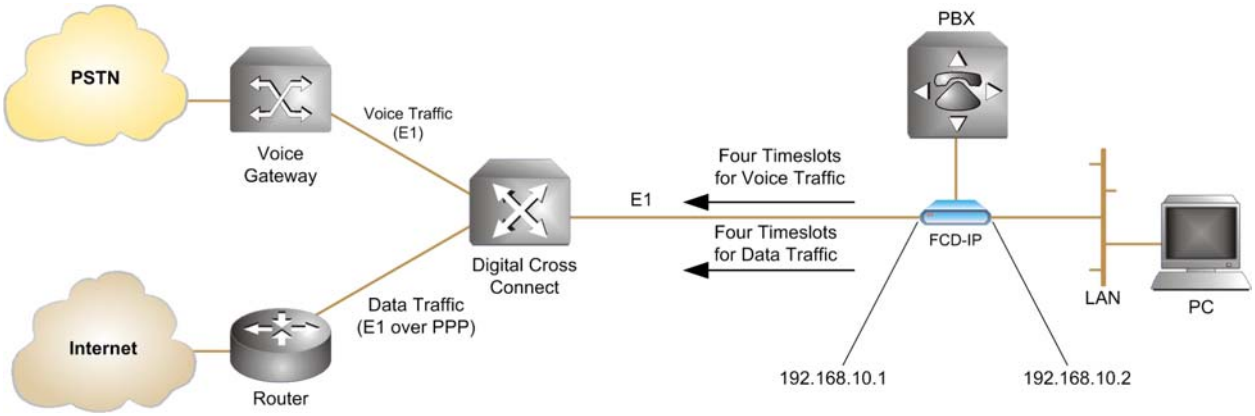


Figure 6-1. FCD-IP Providing Access to the Internet and to the PSTN

Guidelines for Configuring FCD-IP

Certain guidelines are relevant to this application. In general, there are two basic configuration steps (described below) that need to be followed when deploying FCD-IP in this application.

1. WAN interface – Setting WAN interface parameters, including link mode, routing mode and its IP parameters.
2. E1 interface – Configuring E1 link, including mapping timeslots to the relevant user interfaces.

3. LAN interface – Defining host IP parameters, including LAN interface IP address, subnet mask and default gateway.

Table 6-1. Configuration Summary

WAN Parameters	E1 Parameters	LAN Host Parameters
• Link mode: Synchronous • Routing: IP router • Protocol: PPP • WAN IP address: 192.168.10.1 • WAN IP mask: 255.255.255.252	• Master clock: Link 1 • Multiplier: 64 kbps • Timeslots 1–4: FIX SUB Voice • Timeslots 5–8: DATA LINK1	• Host IP address: 192.168.10.2 • Host IP mask: 255.255.255.000 • Default gateway setting by: Interface • Default gateway interface: LINK 1

6.2 Configuring the WAN Interface

➤ To configure the WAN interface:

1. Display the Quick Setup menu (**Main menu** > **Quick Setup**), and configure the WAN interface as follows:
   - Link Status – Enable
   - Link mode – Synchronous
   - Routing – IP router
   - Protocol – PPP
   - WAN IP address – 192.168.10.1
   - WAN IP mask – 255.255.255.252.
2. Type **Y** when asked if you want to configure the E1 interface.

   The E1 Setup menu is displayed (see *Figure 6-3*).

```
QUICK SETUP
 -----------
 WARNING: This device automatically exits to Operational
          Messages 10 minutes after last keyboard action without
          saving parameters
 'ENTER' - Accept parameter , 'SPACE' - Change parameter.
 WAN interface Link 1 - E1
  Link status          : [Enable]
  Link mode            : [Synchronous]
  Routing              : [IP ROUTER], Protocol: [PPP]
  WAN IP address       : 192.168.10.1, enter new : 192.168.10.1
  WAN IP mask          : 255.255.255.252, enter new: 255.255.255.252
  Do you want to configure the E1 Interface parameters (Y/N)?: Y
```

Figure 6-2. Configuring WAN Interface

6.3 Configuring E1 Parameters

➤ To configure E1 parameters:

- From the E1 Setup menu configure the following parameters:
  - Clock Master – LINK 1
  - Multiplier – 64 kbps.

```
E1 Setup: LINK 1 (Device name – FCD-IP)
------------------
 1. Clock Master: [Link 1]
 2. Multiplier  : [64 kbps]
 3. Time slots mapping
 4. General Diagnostics
 5. E1 parameters
 6. Additional Cards parameters
 7. Alarms filter
 8. Advanced Setup

 ESC – Return to previous menu
 Choose one of the above:
```

Figure 6-3. Configuring E1 Parameters

➤ To map E1 timeslots:

1. Display the E1 Timeslots Mapping menu (**E1 Setup** › **Time slots Mapping**), and assign the main link timeslots as follows:
   - TS1, TS2, TS3 and TS4 – FIX SUB Voice
   - TS5, TS6, TS7 and TS8 – DATA LINK 1.
2. From the E1 Timeslots Mapping menu, press **‹Esc›** twice to return to the Quick Setup menu.

```
E1 TIME SLOTS MAPPING: LINK1 (Device name – FCD-IP)
--------------------
   TS1  [FIX  SUB-VOICE]     TS17 [NC            ]
   TS2  [FIX  SUB-VOICE]     TS18 [NC            ]
   TS3  [FIX  SUB-DATA ]     TS19 [NC            ]
   TS4  [FIX  SUB-VOICE]     TS20 [NC            ]
   TS5  [DATA LINK1    ]     TS21 [NC            ]
   TS6  [DATA LINK1    ]     TS22 [NC            ]
   TS7  [DATA LINK1    ]     TS23 [NC            ]
   TS8  [DATA LINK1    ]     TS24 [NC            ]
   TS9  [NC            ]     TS25 [NC            ]
   TS10 [NC            ]     TS26 [NC            ]
   TS11 [NC            ]     TS27 [NC            ]
   TS12 [NC            ]     TS28 [NC            ]
   TS13 [NC            ]     TS29 [NC            ]
   TS14 [NC            ]     TS30 [NC            ]
   TS15 [NC            ]     TS31 [NC            ]
   TS16 [NC            ]

 Enter time slot number (0 refer to all time slots)
 Press 'ENTER' – to toggle the time slot type
 Press 'ESC' - to Return to previous menu
 Time slot number: 5
```

Figure 6-4. Mapping E1 Timeslots

6.4 Configuring LAN Host Parameters

➤ To configure LAN host parameters:

1. From the Quick Setup menu, configure the following LAN interface parameters:
   - LAN Status – Enable
   - LAN IP Address – 192.168.10.2
   - Default gateway setting by – Interface
   - Default gateway interface – LINK 1.
2. Save the changes.

```
QUICK SETUP
 -----------
 WARNING: This device automatically exits to Operational
          Messages 10 minutes after last keyboard action without
          saving parameters
 'ENTER' - Accept parameter , 'SPACE' - Change parameter.
 WAN interface Link 1 - E1
  Link status          : [Enable]
  Link mode            : [Synchronous]
  Routing              : [IP ROUTER], Protocol: [PPP]
  WAN IP address       : 192.168.10.1, enter new : 192.168.10.1
  WAN IP mask          : 255.255.255.252, enter new: 255.255.255.252
  Do you want to configure the E1 Interface parameters (Y/N)?: Y
Host IP setup:
  LAN Status           : [Enable]
  LAN IP address : 192.168.10.2, enter new : 192.168.10.2
  LAN IP mask    : 255.255.255.000, enter new : 255.255.255.000
  Default gateway setting by: [Interface]
  Default gateway interface: [LINK 1]
 SECURITY Setup
  Device access name : FCD-IP
  No password at present – do you want to create password (Y/N)?: [N]
  Security type: [Disabled]

 Saving the changes might cause the unit to RESET.
 Do you want to save QUICK SETUP (Y/N) ? N
```

Figure 6-5. Configuring LAN Interface

Chapter 7

Troubleshooting and Diagnostics

This chapter includes:

- Monitoring performance
- General troubleshooting (see *Table 7-3*)
- E1, T1 and voice troubleshooting (see *Table 7-4*)
- Router connections troubleshooting (see *Table 7-5*)
- Frequently asked questions
- Technical support information.

7.1 Monitoring Performance

Displaying Statistics

Select this option to display information on the traffic between the networks connected by FCD-IP. The statistics enable you to view network performance.

➤ **To access the LAN Statistics screen:**

- Follow the screen path: **Main Menu > View > Statistics**

```
STATISTICS FOR THE LAST 00:03:47 ( Device name - FCD-IP )

     LAN 1  STATISTICS (per second) CURRENT       MAX        AVG
     -----------------
1) Total network frames               00000       00000       00000
2) Received good frames               00000       00000       00000
3) Received good broadcast/multicast 00000       00000       00000
4) Received masked frames             00000       00000       00000
5) Transmitted frames                 00000       00000       00000
6) Memory overflow errors             00000       00000       00000
7) LAN errors                         00000       00000       00000
8) Received missed frames errors      00000       00000       00000
9) LAN buffers overflow               00000       00000       00000

C - Clear statistics, U - Update average,
L - LAN, Link Number
ESC - Return to previous menu
```

Figure 7-1. LAN Statistics

Displaying E1/T1 Diagnostics

Select this option to display error information for the E1/T1 link. This information enables you to evaluate the line quality. The errors are accumulated in 15-minute intervals. FCD-IP keeps up to 96 intervals (for 24 hours).

In addition, there is a rolling 24 hour total of each error parameter. The rolling total is displayed for the interval parameter called TOTAL. The interval parameter called CURRENT is the open interval, which did not yet reach 15 minutes. The errors counted in the CURRENT interval are not included in the TOTAL interval. The amount of time that has elapsed is displayed on the right of the CURRENT parameter line. T1 diagnostics are available only when frame mode is ESF. E1 diagnostics are available only when CRC-4 is enabled.

➤ To access the E1/T1 Diagnostics screen:

- Follow the screen path: Main Menu > View > E1/T1 Diagnostics

```
T1 DIAGNOSTICS - LINK 1 ( Device name - FCD-IP )
-----------------------

INTERVAL    ES      UAS     SES     BES    LOFC     CSS     DM
--------   -----   -----   -----   -----   -----   -----   -----
CURRENT       1     163     173       1       1       0          02.53 min


ESC - previous menu  |  R - Refresh  |  C - Clear diagnostics
```

Figure 7-2. T1 Diagnostics

```
E1 DIAGNOSTICS - LINK 1 ( Device name - FCD-IP )
-------------
 INTERVAL      ES      UAS      SES      BES      LOFC      CSS      DM
 CURRENT        0        0        0        0         0        0           06.15 min
    1           0        0        0        0         0        0
    2           0        0        0        0         0        0
    3           0        0        0        0         0        0
    4           1        0        0        1         0        0
  Total         1        0        0        1         0        0      0

 ESC – previous menu  |  R – Refresh  |   C – Clear diagnostics
```

Figure 7-3. E1 Diagnostics

Displaying Interval Parameters

Table 7-1. Interval Parameters

Parameters	Description
Current Errored Seconds (ES)	An errored second is any second containing one or more CRC error events, one or more OOF events, or one or more controlled slip events.
Unavailable Seconds Out-Of-Frame (UAS)	An unavailable second out-of-frame is any second in which a failed signal state exists. A failed signal state is declared when 10 consecutive severely errored seconds (SES) occur, and is cleared after 10 consecutive seconds of data are processed without a SES.
Severely Errored Seconds (SES)	A SES is a second with 832 or more CRC error events, or one or more OOF events.
Bursty Errored Seconds Out-Of-Frame (BES)	A BES is a second with 2 to 831 CRC error events.
Current Loss of Frame Counter (LOFC)	The loss of frame (LOF) counter counts the loss of frame alignment events.
Current Slip Second Counter (CSS)	A CSS is a second with one or more controlled slip events.
Degraded Minutes (DM)	The total number of degraded minutes in the current 24-hour interval. A degraded minute is a minute in which the bit error rate (BER) exceeded $1x10^{-6}$. This number is updated every minute.

Displaying E1/T1 Alarms Log File

Select this option to display the E1/T1 Alarms Log file.

➤ To access the E1/T1 Alarms screen:

- Follow the screen path: Main Menu > View > E1/T1 Alarms Log File

```
 E1/T1 ALARMS ( Device name – FCD-IP ) time from start – 00:00:09:26
 ------------

INTERFACE           TYPE          STATUS     DAYS     HOURS     MIN     SEC
---------        -----------      ------     ----     -----     ---     ---

Link 1 MAIN E1  CRC-4 error                   0        1         0       0
Link 1 MAIN E1  BPV error                     0        1         0       0
Link 1 MAIN E1  CRC-4 error                   0        1         0       0
Link 1 MAIN E1  BPV error                     0        1         0       0
Link 1 MAIN E1  CRC-4 error                   0        1         0       7
Link 1 MAIN E1  BPV error                     0        1         0       7
Link 1 MAIN E1  CRC-4 error                   0        1         0       7
Link 1 MAIN E1  BPV error                     0        1         0       7
Link 1 MAIN E1  CRC-4 error                   0        1         0       6
Link 1 MAIN E1  BPV error                     0        1         0       6
Link 1 MAIN E1  CRC-4 error                   0        1         0       6
Link 1 MAIN E1  BPV error                     0        1         0       6
Link 1 MAIN E1  CRC-4 error                   0        1         0       5
Link 1 MAIN E1  BPV error                     0        1         0       5
Link 1 MAIN E1  CRC-4 error                   0        1         0       5

ESC – previous menu  |  N – Next page | R – Refresh  |   C – Clear alarms
```

Figure 7-4. E1 Alarms Screen

```
  E1/T1 ALARMS   ( Device name - FCD-IP )   time from start - 00:02:39:39
  ------------

    INTERFACE             TYPE          STATUS   DAYS    HOURS    MIN     SEC
  -------------   ------------------   ------   -----   -----   -----   -----
  Link 1 MAIN T1        Red alarm         ON      0       0       0       2
  Link 1 MAIN T1        Red alarm         ON      0       0       0       2

  ESC - previous menu  |  R - Refresh  |  C - Clear alarms
```

Figure 7-5. T1 Alarms Screen

7.2 Alarm Collection and Reporting

Alarm Buffer

After starting normal operation, FCD-IP continuously monitors critical signals and signal processing functions. In case a problem is detected, the unit generates time-stamped alarm messages that identify all the events.

Note

The default timestamp indicates time elapsed since powering up the device.

If FCD-IP accesses an NTP server, it can timestamp all alarms with time and date learned from the NTP server. This is especially important when many devices are connected to one network and synchronize to the same clock.

The time zone and daylight saving time date are configurable.

FCD-IP stores all alarms in an alarm buffer identified by their time stamps. Newer alarms are displayed before older ones.

The alarms can be read on-line by the network administrator using a Telnet host or a supervision terminal. The network administrator can then use various diagnostic tests to determine the causes of the alarm messages and to return the system to normal operation.

Alarm Display

FCD-IP displays alarm messages on the supervision terminal. There are two types of alarms, designated as ON/OFF and ON:

- An **ON/OFF** alarm is a state alarm. ON means that there is an active alarm in the system. OFF means the alarm is no longer active. FCD-IP cannot enter ON state twice, without it being in OFF state in between.

  When an ON/OFF-type alarm changes its state from ON to OFF, it is not removed from the alarm buffer. The state change is indicated by a new message, which added to the alarm buffer.

- An event. An event occurs, does not persist, and does not have an ON or OFF state. FCD-IP records a single occurrence of event and can record many such events in a row.

➤ **To access the E1/T1 Alarms screen:**

- Follow the screen path: **Main Menu > View > E1/T1 Alarms Log File**

  The terminal displays the alarms stored in the buffer and lists: the interface it was received from, the alarm message, its status (ON or OFF), and the time and date when it was recorded. A typical display (with NTP server not configured) is shown:

```
INTERFACE       TYPE                STATUS  HH:MM:SS  Local Day
Link 1 MAIN E1  Remote multi frame  OFF     00:02:01  0 days
Link 1 MAIN E1  BPV error                   00:02:01  0 days
```

➤ To clear the alarm buffer:

- Press **C** (Clear) when in the log file screen.

Setting the T1 Alarm Filter

The Alarm Log File can show all events and alarm statuses that have occurred in the E1/T1 interface. You can use the Alarm Filter to mask or unmask events from the Alarm Log File.

➤ To access the T1 Alarms Filter menu:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Interface Parameters > E1, T1, Voice Settings > Alarms Filter

```
T1 ALARMS FILTER ( Device name - FCD-IP )
----------------

1.  Frame slip                          : [Unmasked]
2.  BPV error                           : [Unmasked]
3.  Excessive BPV                       : [Unmasked]
4.  Excessive error ratio               : [Unmasked]
5.  Signal loss                         : [Unmasked]
6.  Yellow alarm                        : [Unmasked]
7.  Red alarm                           : [Unmasked]
8.  AIS red alarm                       : [Unmasked]
9.  AIS                                 : [Unmasked]
10. Network loop - LLB                  : [Unmasked]
11. Network loop - PLB                  : [Unmasked]

ESC - Return to previous menu

Choose one of the above:
```

Figure 7-6. T1 Alarms Filter Menu

Setting the E1 Alarm Filter

The Alarm Log File shows all events and alarm statuses that have occurred in the E1/T1 interface. You can use the Alarm Filter to mask or unmask events from the Alarm Log File.

➤ To access the E1 Alarms Filter screen:

- Follow the screen path: Main Menu > Advanced Setup > Setup > Interface Parameters > E1, T1, Voice Settings > Alarms Filter

```
E1 ALARMS FILTER ( Device name – FCD-IP )
-----------------------
1. Frame slip                          : [Unmasked]
2. BPV error                           : [Unmasked]
3. Excessive BPV                       : [Unmasked]
4. CRC-4 error                         : [Unmasked]
5. Excessive error ratio               : [Unmasked]
6. Signal loss                         : [Unmasked]
7. Remote sync loss                    : [Unmasked]
8. Local sync loss                     : [Unmasked]
9. Local multi frame alarm             : [Unmasked]
10. Remote multi frame alarm           : [Unmasked]
11. AIS red alarm                      : [Masked]
12. AIS                                : [Unmasked]

ESC – Return to previous menu
```

Figure 7-7. E1 Alarms Filter Screen

Alarm Messages

Table 7-2 presents the alarm messages displayed on the FCD-IP control terminal and lists the actions required to correct the alarm condition.

Table 7-2. FCD-IP Alarm Messages

Terminal Message	Description	Corrective Actions	Type
SIGNAL LOSS	Loss of main link port receive signal	1. Check cable connections to the link connector 2. Check line and/or other communication equipment providing the link to the remote unit 3. Check FCD-IP E1/T1 configuration	ON/OFF
BPV ERROR	Bipolar violations in the main link receive signal. Updated once per second	Check the main link.	Event
CRC-4 ERROR	CRC-4 errors detected in the main link receive signal. Updated once per second	Check the link.	Event
AIS OCCURRED	AIS is detected on the link	Problem at the equipment connected to the remote end of the link	ON/OFF
AIS SYNC LOSS	Local loss of frame synchronization alarm on the main link, caused by AIS condition	Problem at the equipment connected to the remote end of the link	ON/OFF
LOCAL SYNC LOSS	Local loss of frame synchronization alarm on the main link	1. Check cable connections to the link connector 2. Check line and/or other communication equipment providing the link to the remote FCD-IP 3. Check FCD-IP E1/T1 configuration	ON/OFF
LOCAL MF ALARM	Local loss of multiframe synchronization alarm on the main link	1. Check that the correct framing mode is used at the local and remote ends 2. Perform the corrective actions listed for LOCAL SYNC LOSS	ON/OFF
REMOTE MF ALARM	Remote loss of multiframe synchronization alarm on the main link	Problem at the remote equipment	ON/OFF

Terminal Message	Description	Corrective Actions	Type
REMOTE SYNC LOSS	Remote loss of frame synchronization alarm on the main link	Problem at the remote equipment. Perform the following checks on the remote equipment: 1. Check cable connections to the link connector 2. Check line and/or other communication equipment providing the link to the remote equipment 3. Check FCD-IP E1/T1 configuration	ON/OFF
FRAME SLIP	Frame slips are detected on the main link. Updated once per second. *Note*: This alarm message is not displayed during local loss of frame synchronization	1. Incorrect selection of master clock source 2. Problem at far end (unstable clock source)	Event

7.3 General Troubleshooting

Table 7-3. General Troubleshooting

Trouble symptoms	Possible cause	Recommended Course of Action
All front panel indicators are OFF	The unit is not receiving power	Check that power is supplied to the unit. Check the fuse and replace it if necessary.
READY indication is OFF	There are less then two interfaces are up	Check interface connection status

7.4 Pinging Remote Hosts

The Diagnostic Tools menu has a Ping option. The Ping option allows you to confirm IP connectivity by pinging other IP hosts. If there is a reply from the remote IP host, connectivity is confirmed (see *Figure 7-10*).

Note *Ping only works in the bridge and router modes.*

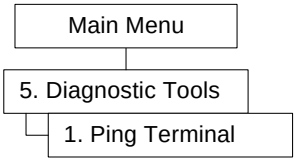


Figure 7-8. Diagnostic Tools Menu Outline

➤ To access the Diagnostic Tools menu:

- Follow the screen path: Main Menu > View > E1/T1 Alarms Log File

```
DIAGNOSTIC TOOLS ( Device name – FCD-IP )
----------------
1. Ping terminal
 ESC - Return to previous menu
 Choose one of the above:
```

Figure 7-9. Diagnostic Tools Menu

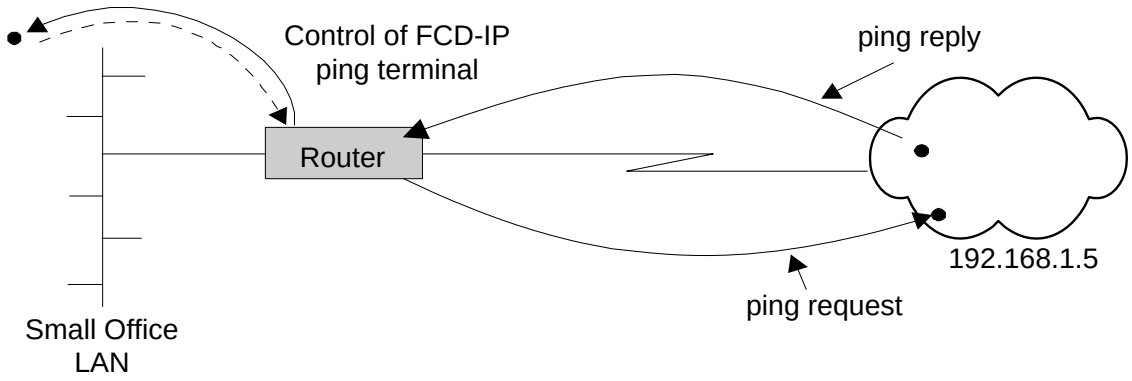


Figure 7-10. Pinging an IP Host

➤ **To ping another host:**

1. From the **Main Menu**, select option **Diagnostic Tests**.

   The Diagnostic Tools menu appears.

2. From the **Diagnostic Tools** menu, select option **Ping Terminal**.

   You are prompted to enter the **IP address of the host**.

3. Enter the host's IP address. FCD-IP pings the destination host.

   A message appears showing the result of the request (see *Figure 7-11*). FCD-IP continues pinging the host until you press **<Esc>.**

```
PING TERMINAL ( Device name – FCD-IP )
-------------
Insert the target IP address in the format: xxx.xxx.xxx.xxx
ESC - Return to previous menu
Ping IP address: 10.10.10.10

Pinging 10.10.10.10

Reply from 10.10.10.10: time = 0.100 sec
Reply from 10.10.10.10: time = 0.050 sec
Reply from 10.10.10.10: time = 0.050 sec
Reply from 10.10.10.10: time = 0.050 sec

ESC - Return to previous menu
```

Figure 7-11. Ping Terminal Screen

7.5 E1/T1 and Voice Troubleshooting

Table 7-4. E1, T1 and Voice Troubleshooting

Trouble symptoms	Possible cause	Recommended Course of Action
Local sync loss (for E1) or RED alarm (for T1) indicator is ON in the main link	External problem	Check the E1/T1 cable.
Local sync loss (for E1) or RED alarm (for T1) indicator is ON in a sub link	External problem	Check the E1/T1 cable.

7.6 Router Connections Troubleshooting

The IP router can be connected to other IP networks by the LAN and WAN.

Operating the PING terminal sending PING frames to IP host indicates the availability of the connection in IP level. When the ping terminal gets responds continuously from the IP host the IP connection is up.

IP connection to LAN is Down

See LAN indicators, **View > Interface Connection** and **View > Routing Tables > IP Routing**.

Table 7-5. Router Connections Troubleshooting

Trouble symptoms	Possible cause	Recommended Course of Action
LAN error indication ON permanently	1. LAN status is DISABLE	Check the interface connection status.
	2. Problem with LAN cable or hub	Check LAN cable and hub.
LAN error indication is blinking	Problem with LAN cable or hub	Check LAN cable and hub.
Physical connection OK but no IP connection	IP configuration problem	Look for mistakes in IP routing table, host IP addresses, default gateway.

IP Connection to WAN is Down

See WAN indicators, **View > Configuration**, **View > Interface Connection** and **View > Routing Tables > IP Routing**.

Table 7-6. IP Connection to WAN Troubleshooting

Trouble symptoms	Possible cause	Recommended Course of Action

WAN error indication ON permanently or connection status shows "sync not obtain"	1. In synchronous link – receive clock (RCLK) is 0 kbps	Check VIEW configuration – baud rate 0 kbps indicates line physical problem.
	2. WAN line physical problem.	Check WAN cable and modem.
WAN error indication ON permanently or connection status shows "sync not obtain"	WAN line physical problem	Check WAN cable and modem.
E1/T1 alarm indicators ON or blinking or connection status shows E1/T1 alarms	E1/T1 physical problem	See E1/T1 troubleshooting.
For PPP: connection status shows "sync not obtain"	There is physical connection but no PPP connection	Check if the unit opposite is ON. Check PPP configuration of FCD-IP and the unit opposite.
For PPP: connection status shows "LCP"	PPP connection establish but no IPCP connection	Check PPP configuration of FCD-IP and the unit opposite.
For Frame Relay: connection status shows "port down"	There is physical connection but no frame relay port UP	Check connection between modem and frame relay switch. Check FCD-IP and switch configuration.
For Frame Relay: link connection status shows "port UP" and DLCI connection shows "DLCI down"	There is physical connection UP and frame relay port UP but specific DLCI is down	Check if the unit opposite the DLCI is ON. Check FCD-IP, frame relay switch and the opposite unit configuration.
Physical and logical connections are OK but no IP connection	IP configuration problem	Look for mistakes in IP routing table, host IP addresses, default gateway.

7.7 Performing T1 Diagnostics

Select this option to allow you to select the card on which the diagnostics is to be performed. A toggle option appears on the bottom of the screen. Use the spacebar to toggle between the card types. Press **<Enter>** to access the diagnostics screen.

For the cards:

- Main Link
- Sub1
- Sub2
- Sub3.

The E1/T1 Loopback diagnostic test is selected.

For the cards:

- Voice.

Voice Diagnostics is selected.

Running Loopbacks

Loopback options are:

- **Disabled**
- **Main Link Remote Analog Loopback** – In this mode, FCD-IP performs an analog loopback and transmits back the data that was received from the T1 line. The loopback is shown in *Figure 7-12*.

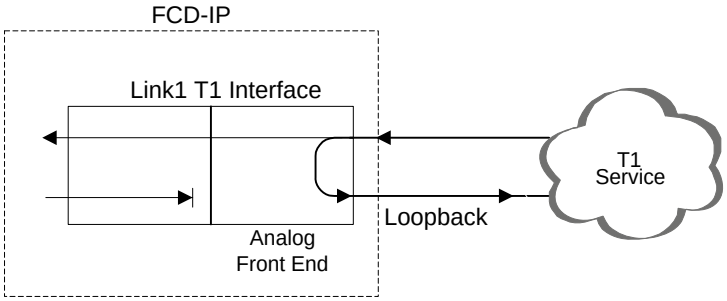


Figure 7-12. Remote Analog Loopback

- **Sublink Remote Analog Loopback** (for FCD-IP with a sublink) – In this mode, FCD-IP performs an analog loopback and transmits back the data that was received from the sub-T1 line. The loopback is shown in *Figure 7-13*.

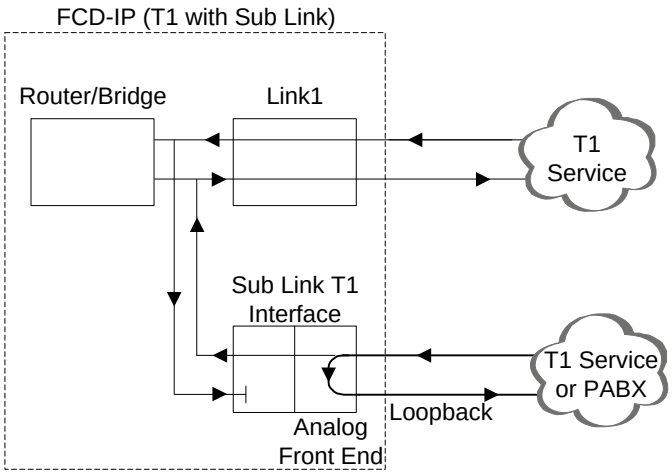


Figure 7-13. Remote Analog Loopback for T1 and Sub T1 Links

- **Main Link Remote Digital Loopback** – In this mode FCD-IP performs a digital loopback and transmits back the signal that was received from the T1 line. The loopback is shown in *Figure 7-14*.

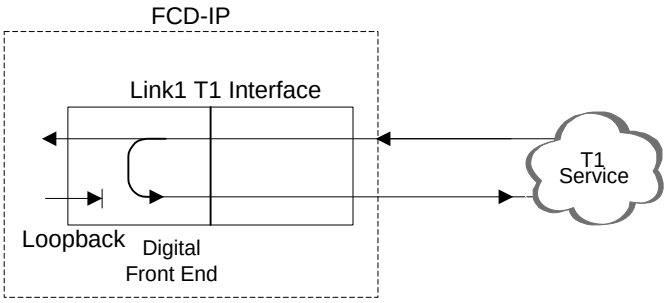


Figure 7-14. Remote Digital Loopback

- **Sublink Remote Digital Loopback** (for FCD-IP with a sublink) – In this mode FCD-IP performs a digital loopback and transmits back the signal that was received from the sub-T1 line. The loopback is shown in *Figure 7-15*.

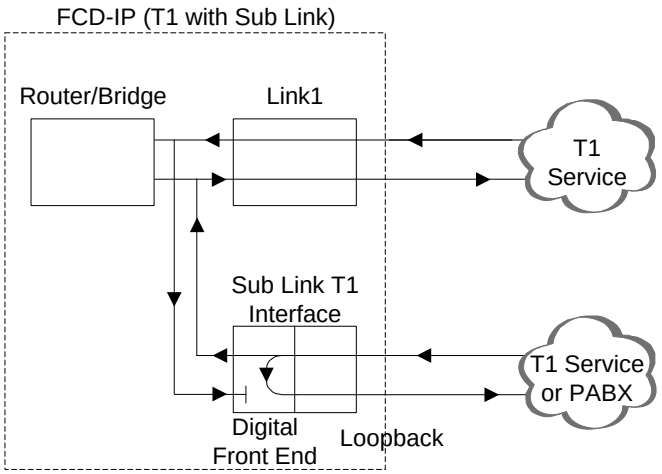


Figure 7-15. Remote Digital Loopback for T1 and Sub T1 Links

- **Main Link Local Analog Loopback** – In this mode the data transmitted from FCD-IP to the T1 line is sent back to the receive path instead of the received data from the T1 line. The loopback is shown in *Figure 7-16*.

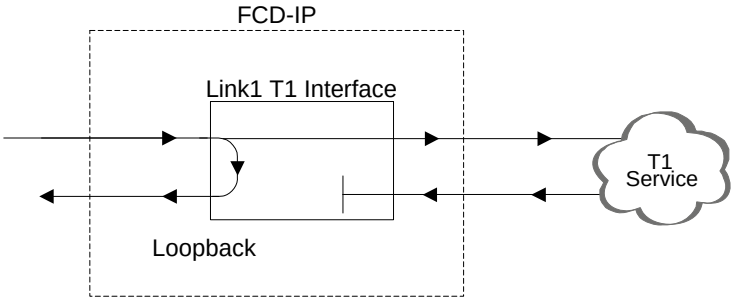


Figure 7-16. Local Analog Loopback

- **Sublink Local Analog Loopback** (for FCD-IP with a sublink) – In this mode the data transmitted from FCD-IP to the sub-T1 line is sent back to the receive path instead of the received data from the sub T1 line. The loopback is shown in *Figure 7-17*.

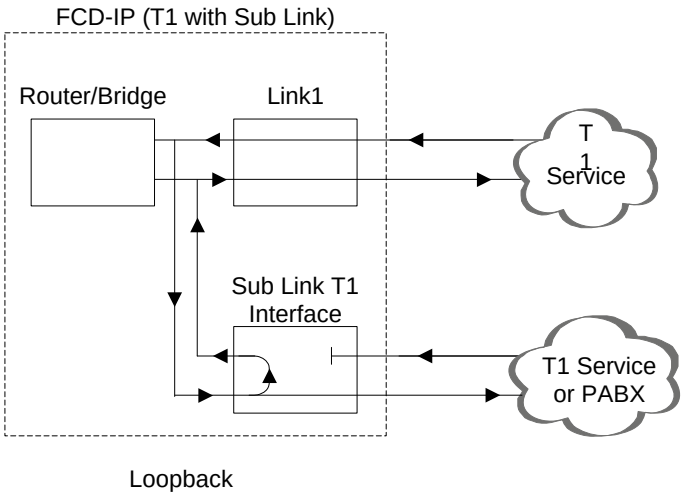


Figure 7-17. Local Analog Loopback for T1 and Sub T1 Links

Using Voice Diagnostic Tools

There are three voice diagnostic tools that are available for FCD-IP. They can be set independently for each voice port:

- **Tone injection to the voice port –** a 1 kHz signal is injected into the receive voice port path, replacing any receive signal from T1
- **Tone injection to the T1 –** a 1 kHz signal is injected into the receive voice port path, replacing any receive signal from T1, and injected into the T1 transmit path, replacing any transmit signal to T1
- **Remote port loopback –** the voice port signal which is received from T1 is transmitted back to T1.

7.8 Performing E1 Diagnostics

Select this option to allow you to select the card on which the diagnostics is to be performed. A toggle option appears on the bottom of the screen. Use the Space bar to toggle between the card types. Press Enter to access the diagnostics screen.

For the cards:

- Main Link
- Sub1
- Sub2
- Sub3.

The E1/T1 Loopback diagnostic test is selected.

For the cards:

- Voice.

Voice Diagnostics is selected.

Running Loopbacks

Loopback options are:

- **Disabled**
- **Main Link Remote Analog Loopback** – In this mode, FCD-IP performs an analog loopback and transmits back the data that was received from the E1 line. The loopback is shown in *Figure 7-18*.

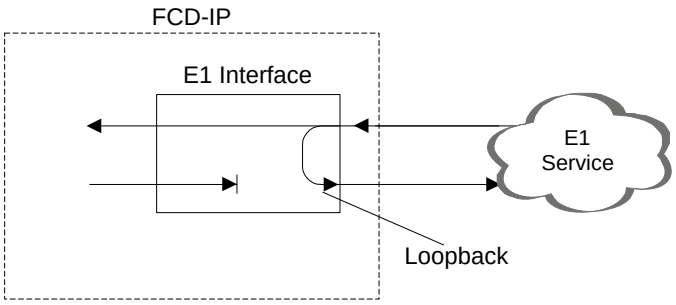


Figure 7-18. Remote Analog Loopback

- **Sublink Remote Analog Loopback** (for FCD-IP with a Sublink) – In this mode, FCD-IP performs an analog loopback and transmits back the data that was received from the sub E1 line. The loopback is shown in *Figure 7-19*.

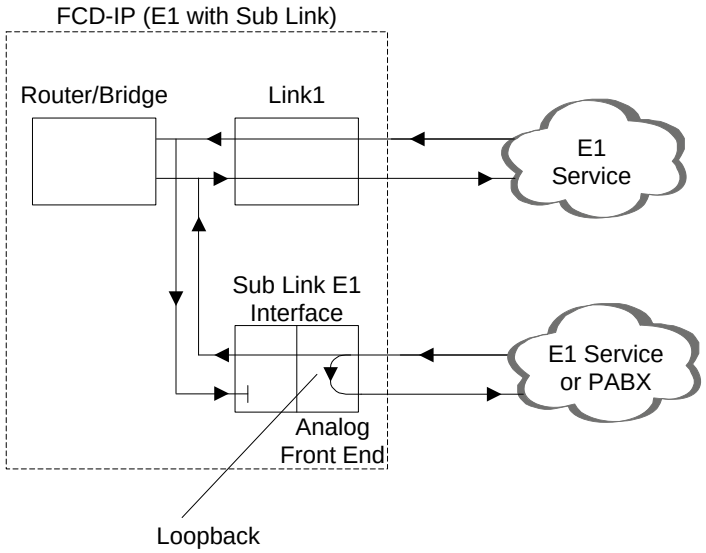


Figure 7-19. Remote Analog Loopback for E1 and Sub E1 Links

- **Main Link Local Analog Loopback –** In this mode, the data transmitted from FCD-IP to the E1 line is sent back to the receive path, instead of the data received from the E1 line. The loopback is shown in *Figure 7-20*.

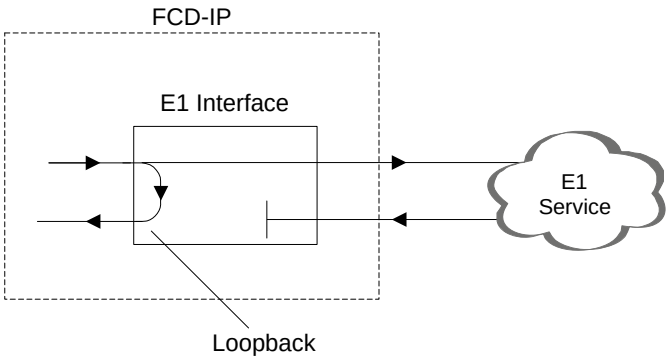


Figure 7-20. Local Analog Loopback

- **Sublink Local Analog Loopback** (for FCD-IP with a Sublink) – In this mode the data transmitted from FCD-IP to the sub E1 line is sent back to the receive path instead of the received data from the sub E1 line. The loopback is shown in *Figure 7-21*.

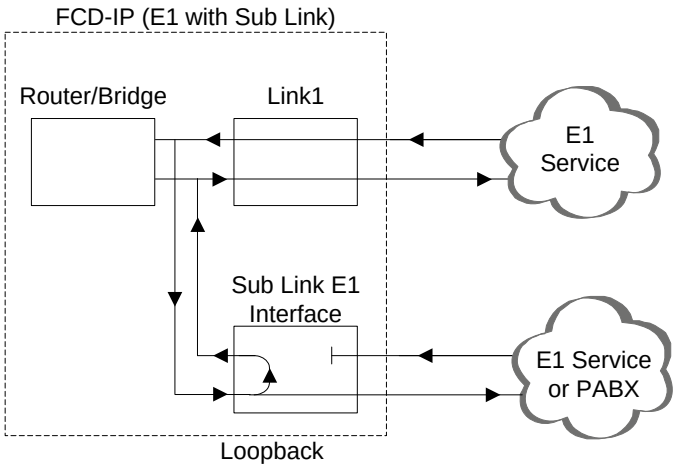


Figure 7-21. Local Analog Loopback for E1 and Sub E1 Links

Using Voice Diagnostic Tools

There are three voice diagnostic tools that are available for FCD-IP. They can be set independently for each voice port:

- **Tone injection to the voice port** – a 1 kHz signal is injected into the receive voice port path, replacing any receive signal from E1
- **Tone injection to the E1** – a 1 kHz signal is injected into the receive voice port path, replacing any receive signal from E1, and injected into the E1 transmit path, replacing any transmit signal to E1
- **Remote port loopback** – the voice port signal which is received from E1 is transmitted back to E1.

7.9 Frequently Asked Questions

Q: Does FCD-IP support the E1/T1 bypass option using a fiber optic uplink?

A: No. The bypass option only exists for an electrical E1/T1 interface.

Q: Which frame type can I use on the E1 uplink of FCD-IP if I have an analog interface and sub-E1 as user interfaces?

A: Whenever FCD-IP includes an analog interface (FXS, E&M, FXO), the E1 main link is automatically forced to work in G.732S mode (i.e. CAS-enabled mode). There is no option to change the settings of the E1 main link to G.732N. If you want to transport also CCS-based signaling from the sub-E1, you need to make sure that the signaling timeslot is not transmitted over timeslot 16.

Q: What modem speed is supported by the FXS card of FCD-IP?

A: The FXS card (Q-LIC FXS REV 2.00) supports modem speed of up to 33.6 kbps.

Q: How does FCD-IP handle VLAN-tagged frames?

A: FCD-IP handles VLAN-tagged frames only in bridge mode. In this mode VLAN-tagged frames are transparently forwarded. There is no ability to perform switching according to VLAN tagging or priority, or to add/take off a VLAN tag.
In router mode VLAN-tagged frames are discarded?

Q: When using an FCD-IP with two LAN ports and an E1 uplink, can I allocate different timeslots on the E1 for LAN 1 and LAN 2 (to operate as a channelized router)?

A: No, this is not possible. The two LAN ports of FCD-IP are connected to one internal router, and they share the same bandwidth, which is allocated for the router on the E1. This means that the timeslot allocation on the E1 is not done per LAN port, but for the two of them together. Nevertheless, each LAN port can be on a different subnet, to enable the connection of two different networks over the E1 link.

Q: Can the FCD-IP /E&M operate as an open voice channel intercom?

A: Yes, this is possible.
FCD-IP is designed such that if signaling leads are not connected, then the voice (2- or 4-wire) is forwarded transparently and the voice connection is in "permanently open" status. This application actually creates an open voice channel between two sites. In this case the "Signaling Type" parameter of FCD-IP is not relevant.
If a controlled connection is required (off-hook/on-hook) and not a permanent one (for example plain E&M connection between PBXs or voice switches), then the signaling leads should be connected and the proper signaling type should be configured for FCD-IP.

Q: Is it possible to transfer asynchronous data over FCD-IP with V.24 DCE interface?

A: Yes, this is possible.
Although the N × 64 kbps V.24 DCE port always works in synchronous mode, it is possible to run asynchronous traffic over it, using the oversampling method. This method is used to perform a sync to async conversion.
The synchronous port samples the asynchronous data according to a certain sampling clock. The important thing here is that the sampling clock should be at least four times higher than the asynchronous rate.
For example, for transferring 9.6 kbps asynchronous data, one timeslot must be allocated for the V.24 DCE port on the FCD-IP E1 main link.
The following application should be used:
Async device--V.24C/FCD-IP--E1 (1 TS)--FCD-IP/V.24C--async device.
Note that although the V.24 DCE port actually outputs a synchronous 64 kbps stream, the asynchronous device identifies t as 9.6 kbps.

7.10 Technical Support

Technical support for this product can be obtained from the local distributor from whom it was purchased.

For further information, please contact the RAD distributor nearest you or one of RAD's offices worldwide. This information can be found at www.rad.com (offices – About RAD › Worldwide Offices; distributors – Where to Buy › End Users).

Appendix A

Interface Specifications and Pinouts

This appendix lists the cable types and connector specifications.

A.1 Interface Signal List (Female Connectors)

The following section provides information on the different interfaces for the FCD-IP. *Table A-1* provides a list of interface signals.

Table A-1. Interface Signal List (Female Connectors)

Signal Function	Source	V.24/ RS-232 DB-25 (Female)	V.35** 34-PIN (Female) Pin	V.35** 34-PIN (Female) Circuit	EIA-530 DB-25 (Female) Pin	EIA-530 DB-25 (Female) Circuit	V.36/ RS-449** DB-37 (Female) Pin	V.36/ RS-449** DB-37 (Female) Circuit	X.21* DB-15 (Female) Pin	X.21* DB-15 Circuit [Function]	Description
Protective Ground	Common	1	A Frame	101	1		1		1	- [shield]	Chassis ground. May be isolated from Signal Ground.
Signal Ground	Common	7	B Signal GND	102	7	AB	19	SG	8	- [GND]	Common Signal and DC power supply ground.
Transmitted Data	DTE	2	S TD(B) P TD(A)	103 103	2 14	BA (A) BA (B)	4 22	SD(A) SD(B)	2 9	T(A) T(B) [TRANSMIT]	Serial data output from FCD-IP. The data transitions occur on the rising edge of the clock.
Received Data	DCE	3	E DSR	104 104	3 16	BB(A) BB(B)	6 24	RD(A) RD(B)	4 11	R(A) R(B) [RECEIVE]	Serial data input to FCD-IP. The data transitions occur on the rising edge of the clock.

Table A-1. Interface Signal List (Female Connectors) (Cont.)

Signal Function	Source	V.24/ RS-232 DB-25 (Female)	V.35** 34-PIN (Female) Pin	V.35** 34-PIN (Female) Circuit	EIA-530 DB-25 (Female) Pin	EIA-530 DB-25 (Female) Circuit	V.36/ RS-449** DB-37 (Female) Pin	V.36/ RS-449** DB-37 (Female) Circuit	X.21* DB-15 (Female) Pin	X.21* DB-15 Circuit [Function]	Description
Request to Send	DTE	4	C RTS	105	4 19	CA(A) CA(B)	7 25	RS(A) RS(B)	3 10	C(A) C(B) [CONTROL]	ON from the unit upon completion of Self-Test.
Clear To Send	DCE	5	D CTS	106	5 13	CB(A) CB(B)	9 27-	CS(A) CS(B)	-	-	FCD-IP expects CTS ON.
Data Set Ready	DCE	6		107	6 22	CC(A) CC(B)	11 29	DM(A) DM(B)	-	-	Not used.
Data Terminal Ready	DTE	20	H DTR	108	20 23	CD(A) CD(A)	12 30	TR(A) TR(B)	-	-	ON when FCD-IP is ready to transmit or receive data.
Carrier Detect	DCE	8	F DCD	109	8 10	CF(A) CF(B)	13 31	RR(A) RR(B)	5 12	I(A) 1(B) [INDICATION]	Unit expects DCD ON
Transmit Clock	DCE	15	Y SCT(A) A SCT(B)	114 114	15 12	DB(A) DB(B)	5 23	ST(A) ST(B)	6 13	S(A) S(B) [SIGNAL TIMING]	FCD-IP requires clock for synchronization (in synchronous mode).
Receive Clock	DCE	17	X SCR(B) V SCR(A)	115 115	17 9	DD(A) DD(B)	8 26	RT(A) RT(B)	-	-	FCD-IP requires clock for synchronization (in synchronous mode).

**The X.21 connection is made by an RS-530 to X.21 conversion cable supplied with the RS-530 model.*

***The V.36/RS-449 connection is made by an RS-530 to V.36 conversion cable supplied with the RS-530 model.*

Figure A-1 shows the pinout for the cable supplied with the X.21 interface.

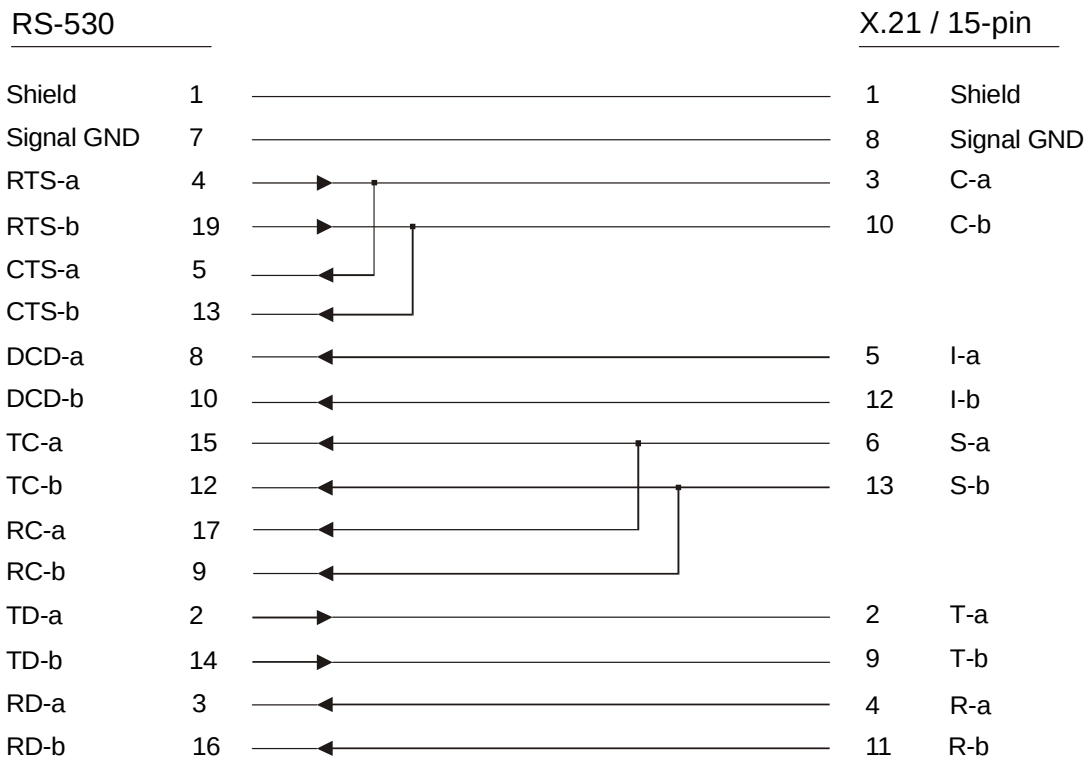


Figure A-1 Cable Supplied for X.21 Interface

Figure A-2 shows the pinout for the cable supplied with the V.36 interface.

RS-530			RS-449/V.36 37-pin	
Shield	1	———	1	Shield
TD-a	2	———	4	SD-a
TD-b	14	———	22	SD-b
RD-a	3	———	6	RD-a
RD-b	16	———	24	RD-b
RTS-a	4	———	7	RS-a
RTS-b	19	———	25	RS-b
CTS-a	5	———	9	CS-a
CTS-b	13	———	27	CS-b
DSR-a	6	———	11	DM-a
DSR-b	22	———	29	DM-b
DTR-a	20	———	12	TR-a
DTR-b	23	———	30	TR-b
Sig. GND	7	———	19, 20, 37	SG
DCD-a	8	———	13	RR-a
DCD-b	10	———	31	RR-b
TC-a	15	———	5	ST-a
TC-b	12	———	23	ST-b
RC-a	17	———	8	RT-a
RC-b	9	———	26	RT-b
LL	18	———	10	LL
RL	21	———	14	RL
EXT-CK-a	24	———	17	TT-a
EXT-CK-b	11	———	35	TT-b
TM	25	———	18	TM

Figure A-2. Cable supplied for V.36 interface

A.2 E1/T1 Connectors

The following section provides information on the main and sub link connectors. The connectors are provided as follows:

- The unbalanced interface of the E1 and SUB E1 links are terminated in two BNC connectors. The connectors are designated RX-IN and TX-OUT.
- The balanced interface of the E1, SUB E1, T1 and SUB T1 are terminated in an eight-pin RJ-45 connector, wired in accordance with *Table A-2.*

Table A-2. E1/T1 and SUB E1/T1 Link Connectors, Pin Allocation

Pin	Designation	Direction	Function
1	RD (R)	Input	Receive data (ring)
2	RD (T)	Input	Receive data (tip)
3, 6	–	–	FGND
4	TD (R)	Output	Transmit data (ring)
5	TD (T)	Output	Transmit data (tip)
7, 8	–	N/A	Not connected

Note

To connect the PBX to the SUB E1/T1 link, use a cross cable.

Balanced-to-Unbalanced Adapter Cable (Y-Cable)

FCD-IP E1 interfaces (main link and sublink) only have an RJ-45 connector, which is normally used for balanced E1. If an unbalanced interface is required, then a special adapter cable is required. For that purpose, RAD offers a 150-mm long adapter cable, CBL-RJ45/2BNC/E1, wired in accordance with *Figure A-3*.

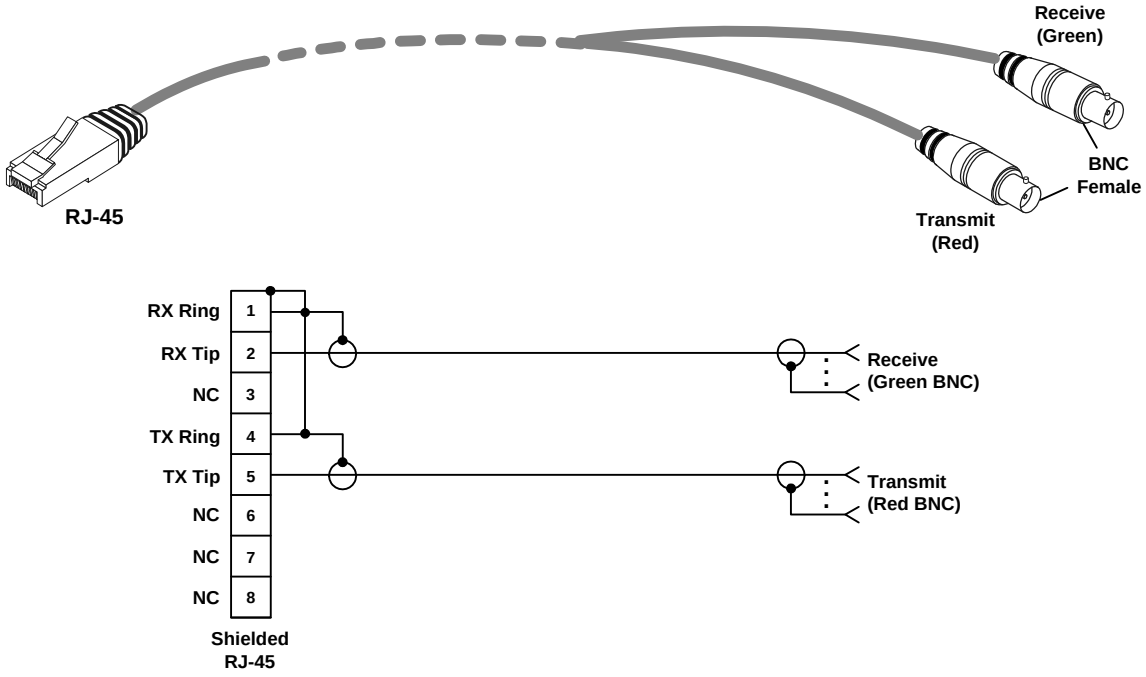


Figure A-3. CBL-RJ45/2BNC/E1 Cable Wiring Diagram

A.3 Control Cable Connector

The control cable connection pinout is provided in *Figure A-5*.

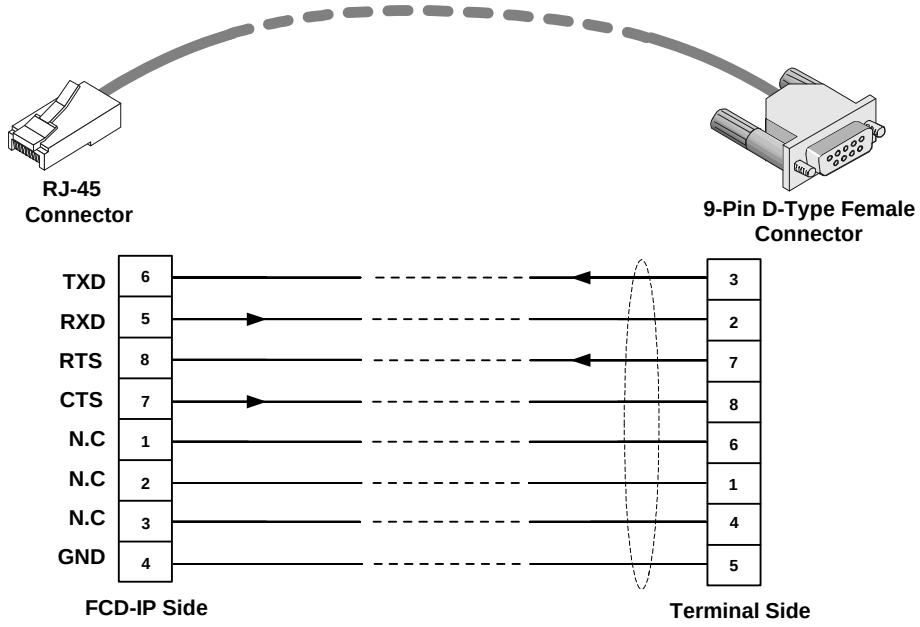


Figure A-4. Wiring of CBL-RJ45/D9/F/6FT Cable

A.4 ISDN Connector

The ISDN connector pinout is provided in *Table A-3*.

Table A-3. ISDN "S" Interface Pin Assignments

Pin Number	Signal Name
3	Tx+
4	Rx+
5	Rx-
6	Tx-

A.5 Fiber Optic Interface

FCD-IP equipped with a fiber optic main link can be used to provide a secure link in hazardous or hostile environments, increase the maximum connection range, and achieve immunity against electrical interference and protection against the deleterious effects of ground loops.

The fiber optic main link interface is terminated in two ST, FC/PC or SC connectors, in accordance with order. *Table A-4* lists the various available fiber optic interface types and their main specifications (maximum ranges are calculated assuming a 3 dB margin).

Table A-4. Fiber Optic Interface Specifications

Wavelength [nm], **Fiber Type** [μm]	**Budget** [dB]	**Typical Range** [km/miles]	**Connector**
850, 62.5/125, multimode	12	3.5/2.1	SC, ST, FC
1310, 9/125, single mode	15	33/20.5	SC, ST, FC
1310L, 9/125, single mode	25	50/31	SC, ST, FC
1550L, 9/125, single mode	25	100/62	SC, ST, FC

All the fiber optic interface options offer high performance and have a wide dynamic range. This ensures that the receiver will not saturate even when using short fiber optic cables (saturation is caused when the optical power applied to the receiver exceeds its maximum allowed input power, and results in very high bit error rates).

A.6 E&M Connector

The RJ-45 E&M connector wiring is provided in *Table A-5*.

Table A-5. RJ-45 E&M Connector Wiring

Pin	Designation	Function
1	SB	Signalling Battery
2	M	M Lead input
3	R1-OUT	4-wire voice output 2-wire voice input/output
4	R-IN	4-wire voice intput
5	T-IN	4-wire voice intput
6	T1-OUT	4-wire voice output 2-wire voice input/output
7	SG	Function depends on signalling mode: RS-464 Type I, III Direct connection to singal ground RS-464 type V, SSDC5 Connection to signal ground through 1.1 K resistor RS-464 Type II SG lead
8	E	E lead output

A.7 FXO/FXS Connector

The RJ-11 FXS and FXO connector wiring is provided in *Table A-6*.

Table A-6. RJ-11 FXS and FXO Connector Wiring

Pin	Designation	Direction	Function
1, 2			Not connected
3	RING	IN/OUT	2W input/output
4	TIP	IN/OUT	2W input/output
5, 6			Not connected

Appendix B

Boot Manager

This appendix describes the various options of the Boot Manager.

B.1 Preface

FCD-IP includes Dual Image Flash memory, capable of storing two different versions of software in two different partitions.

Upon reset, FCD-IP automatically runs the program stored in the **active** partition.

New software versions are loaded into the **backup** partition. If loading succeeds, the **backup** partition becomes the **active** partition and FCD-IP is reset automatically, running the new software version. If loading fails, the device is still capable of working, since the Flash partition storing the old version remains active.

The Boot Manager can control dual Image Flash. Use the Boot Manager to:

- Download new software
- Manually define the active and backup partitions
- Run the backup partition
- Erase some or all information from Flash.

B.2 Accessing Boot Manager

There are several ways to access Boot Manager:

- Via option 2 in the Software Download menu
- Via the "Rescue" option.

Access via Software Download Menu

➤ **To access Boot manager via Software Download menu:**

1. In the Advanced Setup Menu, press **2**. The Device Control menu appears.
2. Press **1**. The Software Download menu appears.
3. Press **2** to display the Boot Manager menu.

Rescue

If FCD-IP does not respond properly, try the Rescue option:

1. Connect the ASCII terminal to FCD-IP.
2. Switch on FCD-IP and immediately press **R.** The Boot Manager menu appears.

B.3 The Boot Manager Menu

Following is a screen display of the Boot manager menu. The options in the Boot Manager menu are described in *Figure B-1*.

➤ **To access the Boot Manager menu:**

- Follow the screen path: **Main Menu > 3 > 2 > 1 > 2**

```
BOOT 360 Version 1.08 (Jun 15 2003)

Active: 2005 Jan 20 16:23 FI400.X      FCD-IP, Version 4.00 (19.1.2005)
Backup: 2005 Jan 20 16:23 FI400.X      FCD-IP, Version 4.00 (19.1.2005)

1) Load new software
2) Partitions status
3) Run backup partition
4) Reactivate backup partition
5) Duplicate active partition
6) Erase configuration
7) Erase all FLASH
8) Set baud rate

0) Exit

Choose one of the above:
```

Figure B-1. Boot Manager Menu

Load New Software

Select this option to download new software via the control port using the XMODEM protocol. During the download process, the new program code is downloaded to the Flash **backup** partition, thus erasing its previous contents.

Upon completion, the newly downloaded Flash partition becomes the **active** partition, while the old version's partition becomes the **backup** partition. The device automatically resets, running the new program stored in the **active** partition. *Figure B-2* shows a dual image flash.

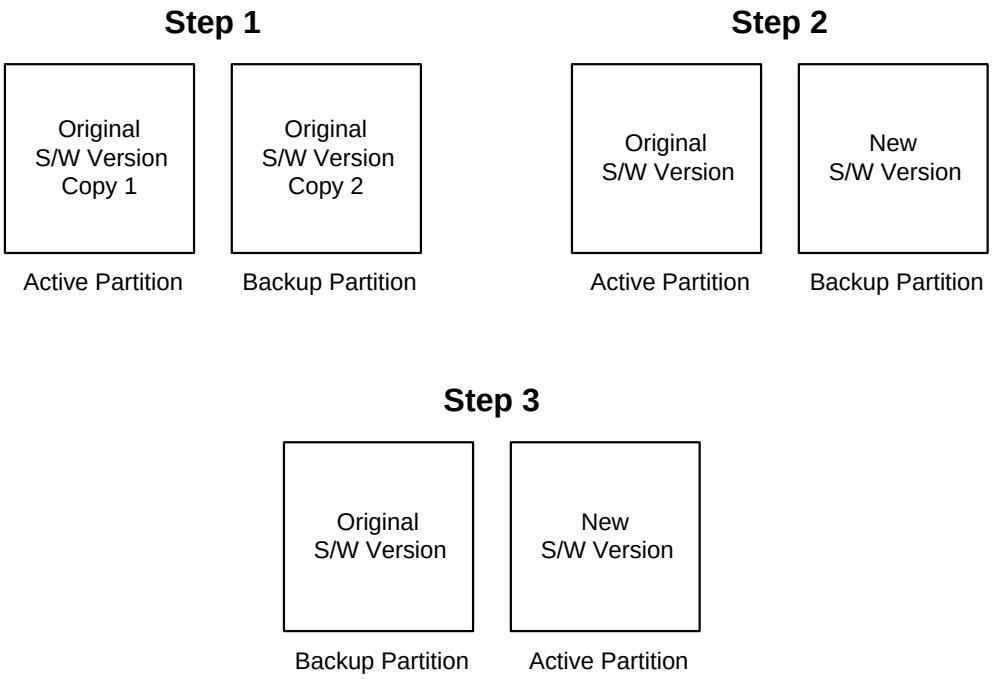


Figure B-2. Dual Image Flash

Note *Windows 95 terminal emulator, HyperTerminal, has the following bug: after changing baud rate, the status line presents the new value, but this value does not come into effect unless you perform the disconnect and connect commands immediately after the change.*

Partitions Status

Select this option to display information about the status of the **active** (first) and the **backup** (second) flash partitions. Note that the Boot Manager menu also displays a partial status at the top of the menu:

```
Active : 2005 Apr 16 14:56 FCD-IP
Backup : 2005 Apr 16 14:56 FCD-IP
```

Run Backup Partition

Select this option to run the program stored in the **backup** partition of the Flash memory. Normally that program is the previous software version.

The "backup" program runs **once**. The next hardware reset or Boot will run the program stored in the **active** partition.

Reactivate Backup Partition

Select this option to turn the **backup** partition into the **active** partition (and vice versa). In this way you can return to the previous software version permanently.

This command may be executed up to 16 times, after which downloading of the new software will be required. Therefore avoid using this option for a one-time run of the old version (use the **Run Backup Partition** option for that purpose).

Duplicate Active Partition

Select this option to duplicate the program stored in the **active** partition into the **backup** partition.

Erase Configuration

Select this option to erase the device configuration parameters. The device configuration parameters are also stored in the flash memory. Sometimes these configuration parameters are needed after downloading a new version of Boot Manager. When the new version's parameter set is not fully compatible with the previous version's parameters, then you need to erase the previous version's parameters. You can also use this command to set the device to the default settings. The Erase Configuration command is also useful if you forget the password.

Erase All Flash

Select this option to erase the device configuration parameters, and the programs stored in both partitions. Remember to download new software before attempting to operate the device.

Set Baud Rate

Select this option to set the device's baud rate to either 9.6, 19.2, 38.4, 57.6 or 115.2 kbps. For software download, it is recommended to use the highest rate possible, i.e., 115.2 kbps. The baud rate must be higher than 9.6 kbps to enable downloading. *Figure B-3* shows a diagram of setting the baud rate.

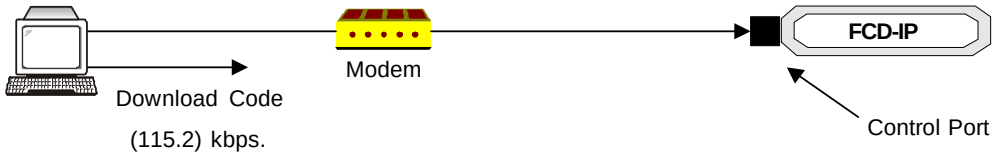


Figure B-3. Setting the Baud Rate

Change your terminal baud rate and press Enter several times to ensure that the device identifies the new value.

Note *Windows 95 terminal emulator, HyperTerminal, has the following bug: after changing baud rate the status line presents the new value, but this value does not come into effect unless you perform the disconnect and connect commands immediately after performing the change.*

Exit

Select this option to exit the Boot Manager menu and perform Boot/RESET FCD-IP.

If the Boot Manager is idle for more the two minutes, exit is performed automatically.

Appendix C

SNMP Management

This appendix provides the specific information required for managing FCD-IP with the Simple Network Management Protocol (SNMP).

C.1 SNMP Environment

This section describes the SNMP environment.

The SNMP management functions of the FCD-IP are provided by an internal SNMP agent, which can use in-band and out-of-band communication.

The SNMP management communication uses the User Datagram Protocol (UDP). UDP is a connectionless-mode transport protocol, part of the suite of protocols of the Internet Protocol (IP).

This section covers the information related to the SNMP environment.

SNMP Principles

The SNMP management protocol is an asynchronous command/response polling protocol. All of the management traffic is initiated by the SNMP-based network management station, which addresses the managed entities in its management domain. Only the addressed managed entity answers the polling of the management station, except for trap messages.

The managed entities include a function called an "SNMP agent", which is responsible for interpretation and handling of the management station requests to the managed entity, and the generation of properly-formatted responses to the management station.

SNMP Operations

The SNMP protocol includes four types of operations:

- **getRequest** – Command for retrieving specific management information from the managed entity. The managed entity responds with a **getResponse** message.
- **getNextRequest** – Command for retrieving sequentially specific management information from the managed entity. The managed entity responds with a **getResponse** message.
- **setRequest** – Command for manipulating specific management information within the managed entity. The managed entity responds with a **getResponse** message.
- **trap** – Management message carrying unsolicited information on extraordinary events (that is, events which occurred not in response to a management operation) reported by the managed entity.

The Management Information Base

The management information base (MIB) includes a collection of ***managed objects***. A managed object is defined as a parameter that can be managed, such as a performance statistics value.

The MIB includes the definitions of relevant managed objects. Various MIBs can be defined for various management purposes, types of equipment, etc.

An object's definition includes the range of values (also called "instances") and the "access" rights:

- **Read-only** - Instances of that object can be read, but cannot be set
- **Read-write** - Instances of that object can be read or set
- **Write-only** - Instances of that object can be set, but cannot be read
- **Not accessible** - Instances of that object cannot be read, nor set.

MIB Structure

The MIB has an inverted tree-like structure, with each definition of a managed object forming one leaf, located at the end of a branch of that tree. Each "leaf" in the MIB is reached by a unique path. By numbering the branching points from the top down, each leaf can be uniquely defined by a sequence of numbers. The formal description of the managed objects and the MIB structure is provided in a special standardized format, called Abstract Syntax Notation 1 (ASN.1).

Since the general collection of MIBs can also be organized in a similar structure, under the supervision of the Internet Activities Board (IAB), any parameter included in a MIB that is recognized by the IAB is uniquely defined.

MIBs are classified in various classes (branches): the experimental branch, and the group of private (enterprise-specific) branch. This is to provide the flexibility necessary in a global structure. Under the private enterprise-specific branch of MIBs, each enterprise (manufacturer) can be assigned a number, which is its enterprise number. The assigned number designates the top of an enterprise-specific sub-tree of non-standard MIBs. Within this context, RAD has been assigned the enterprise number 164. Therefore, enterprise MIBs published by RAD can be found under 1.3.6.1.4.1.164.

MIBs of general interest are published by the IAB in the form of a Request for Comment (RFC) document. In addition, MIBs are also often assigned informal names that reflect their primary purpose. Enterprise-specific MIBs are published and distributed by their originator, which is responsible for their contents.

MIBs Supported by the FCD-IP SNMP Agent

The interpretation of the relevant MIBs is a function of the SNMP agent of each managed entity. The general MIBs supported by the SNMP agent are as follows:

- RFC1213
- RFC1215
- RFC1231
- RFC1659 – RS-232
- RFC1398 – Ethernet (dot3)
- RFC1406 – DS1
- RFC1471 – PPP
- RFC1473 – PPP-IP-Group
- RFC1724 – RIP
- RFC2011
- RFC2096 – IP-FORWARD
- ianaIfType
- RFC2233 – IfMIB
- RFC2127 – ISDN
- RFC2128 – ISDN
- RFC2115 – FR
- RAD private MIB.

In addition, the FCD-IP SNMP agent supports the RAD-private (enterprise-specific) MIB identified as (read the following as a continuous string):

Iso(0).org(3).dod(6).internet(1).private(4).enterprises(1).rad(164)

Enterprise-specific MIBs supported by RAD equipment, including those for FCD-IP, are available in ASN.1 format from the RAD Technical Support Department.

Management Domains Under SNMP

SNMP enables, in principle, each management station that knows the MIBs supported by a device to perform all the management operations available on that device. However, this is not desirable in practical situations, so it is necessary to provide a means to delimit management domains.

SNMP Communities

To enable the delimitation of management domains, SNMP uses "communities". Each community is identified by a name, which is an alphanumeric string of up to 255 characters defined by the user.

Any SNMP entity (this term includes both managed entities and management stations) is assigned by its user a community name. In parallel, the user defines for each SNMP entity a list of the communities which are authorized to communicate with it, and the access rights associated with each community (this is the SNMP community name table of the entity).

In general, SNMP agents support two types of access rights:

- **Read-only** – the SNMP agent accepts and processes only SNMP **getRequest** and **getNextRequest** commands from management stations which have a read-only community name.
- **Read-write** – the SNMP agent accepts and processes all the SNMP commands received from a management station with a read-write community name. SNMP agents are usually configured to send traps to management stations having read-write communities.

Authentication

In accordance with the SNMP protocol, the SNMP community of the originating entity is sent in each message.

When an SNMP message is received by the addressed entity, first it checks the originator's community: messages with community names not included in the SNMP community names table of the recipient are discarded (SNMP agents of managed entities usually report this event by means of an authentication failure trap).

The SNMP agents of managed entities evaluate messages originated by communities appearing in the agent's SNMP Community Names table in accordance with the access rights, as explained above. Thus a **setRequest** for an MIB object with read-write access rights will nevertheless be rejected if it comes from a management station whose community has read-only rights with respect to that particular agent.

C.2 SNMP Configuration

Indexing Convention

The following is the indexing convention of the SNMP configuration:

- Lan1 ifindex = 1
- Lan2 ifindex = 2
- Link1 ifindex = 3
- Link2 ifindex = 4
- E1/T1 Sub2 ifindex = 5
- Voice1 or E1/T1 Sub3 ifindex = 6
- Voice2 ifindex = 7
- Voice3 ifindex = 8
- Voice4 ifindex = 9
- E1/T1 Sub1/Link2 ifindex = 10.

Other indices are dynamic numbers which indicate higher protocol layers of the physical interfaces.

Configuration

➤ To access SNMP configuration:

1. Enter Security Setup menu **2**.
2. Choose Device Access Restrictions **1**.
3. Choose SNMP Access Status: Enable/Disable **4**.

Community Configuration

➤ To enable community configuration:

1. Enter Security Setup menu **2**.
2. Choose Device Access Restrictions **1.**
3. Choose either: SNMP Read **5**, Write **6** or Trap Community **7**, depending on what you want to configure.
4. Configure the community to the same setting as at the NMS station.

Trap Configuration

➤ To enable trap configuration:

- Follow the screen path: **Main Menu › 3 › 1 › 1 › 3 › 1**

1. Add the NMS station IP address to the manager list.
2. Choose YES under MASK parameter to open the trap mask.

C.3 SNMP Traps

The SNMP agent of the FCD-IP supports the standard MIB-II traps. In addition, each FCD-IP alarm is sent as a specific trap to the management station.

Supported Traps

The supported traps are:

- Cold Start
- Link Down
- Link Up
- Authentication Failure
- Dsx1LineStatusChange.

  This trap provides alarm indications for the following alarms:

  - 1 dsx1NoAlarm No alarm present
  - 2 dsx1RcvFarEndLOF Far end LOF (Yellow alarm)
  - 16 dsx1XmtAIS Near end sending AIS
  - 32 dsx1LossOfFrame Near end LOF (Red alarm)
  - 64 dsx1LossOfSignal Near end loss of signal
  - 128 dsx1LoopbackState Near end is looped
  - 512 dsx1RcvFarEndLOMF Far end sending TS16 LOMF
  - 1024 dsx1XmtFarEndLOMF Near end sending TS16 LOMF.

  Dsx1 traps are sent with major severity (except for normal line status traps that are sent with normal severity).

Appendix D

Glossary

10BaseT - 10BaseT is a LAN protocol that allows stations to be attached via twisted pair cable.

ARP (Address Resolution Protocol) - ARP is a method for finding a host's Ethernet address from its Internet address. The sender broadcasts an ARP packet containing the Internet address of another host and waits for the second host to send back its Ethernet address.
ARP is defined in RFC 826.

Bandwidth - Bandwidth is the rate at which data passes through the link. The greater the bandwidth, the more information can be sent through the link at a particular time.

Bridging - Bridging is the forwarding of traffic between network segments based on data link layer information. These segments have a common network layer address.

Broadcast - Broadcast is a transmission to multiple, unspecified recipients. On an Ethernet network, a broadcast packet is a special type of multicast packet which all nodes on the network are always willing to receive.

Default Gateway - Default Gateway is a routing table entry that is used to direct packets addressed to hosts or networks not explicitly listed in the routing table.

DHCP - The Dynamic Host Configuration Protocol (DHCP) provides a framework for passing configuration information to hosts on a TCP/IP network.

DLCI (Data Link Control Identifier) - DLCI is a channel number that is attached to data frames to tell the network how to route the data in Frame Relay Networks.

DNS (Domain Name System) - DNS is a general-purpose distributed, replicated, data query service chiefly used on Internet for translating hostnames into Internet IP addresses.
DNS is defined in STD 13, RFCs 1034 and 1035.

Dynamic Station - A dynamic station is a host that is added automatically to an ARP or LAN table.

E1/T1 - E1/T1 services provide high-speed connections. E1/T1 supports Frame Relay, PPP and HDLC, providing the flexibility to support high-performance point-to-point or point-to-multipoint topologies.

Firewall - A firewall system controls access to or from a protected network (i.e., a site). It implements a network access policy by forcing connections to pass through the firewall, where they can be examined and evaluated.

Frame Relay - Frame Relay is a packet-switching protocol for connecting devices on a WAN. Frame Relay networks support data rates up to 1.544Mbps.

I/O - Data Channel Interfaces that can be operated as n x 64k or n x 56k data port (DCE only).

IP Address - The IP Address is a 32-bit host address. It is usually represented in dotted decimal notation, e.g. 128.121.4.5. The address can be split into a network number (or network address) and a host number unique to each host on the network and sometimes also a subnet address.
IP Address is defined in RFC 791.

IP Mask - The IP mask is a unique 4 byte (32 bit) value that allow the recipient of IP packets to distinguish between different host IDs.

IP/IPX Routing - IP/IPX Routing is the process, performed by a router, of selecting the correct interface and next hop for a packet being forwarded. Routing is done in order to send a packet to a specific destination.

IPX (Internetwork Packet Exchange) - IPX is a network layer protocol used in Novell NetWare file server operating system.
A router with IPX routing can interconnect LANs so that Netware clients and servers can communicate.

Leased Lines - A leased line is a private telephone circuit permanently connecting two points, normally provided on a lease by a local PTT.

MAC (Media Access Control) - MAC is the lower sublayer of the data link layer. MAC is the interface between a node's Logical Link Control and the network's physical layer. The MAC differs for various physical media.

MAC Address - The MAC Address is the hardware address of a device connected to a shared network medium.

Mask - A mask is a filtering aid that is used to define classes of addresses. By defining classes, any packet can be judged as to whether it should pass the filter or not.

MTU (Maximum Transmit Unit) - The Maximum Transmission Unit is the largest frame length which may be sent on a physical medium.

MultiCast - MultiCast is an Ethernet addressing scheme used to send packets to devices of a certain type or for broadcasting to all nodes.

NAT – Network Address Translation converts source/destination IP/UDP ports according to management configurations. Address translation allows hosts in a private network and vice versa. NAT is implemented by modifying end node addresses en-route and maintaining a state for these updates so that datagrams pertaining to a session are routed to the right end-node in either realm.
This solution only works when the applications do not use the IP addresses as part of the protocol itself. Even if the NAT includes a mechanism for changing the upper layer protocols IP, encrypted frames will fail in the NAT.

NCP (NetWare Core Protocol) - NCP is a Novell trademark for the protocol used to access Novell NetWare file and print service functions. NCP uses an underlying IPX or IP transport protocol.

NetBEUI (NetBIOS Extended User Interface) - NetBEUI is the network transport protocol used by all of Microsoft network systems and IBM LAN Server based systems.

Parity - Parity is an extra bit added to a byte or word to reveal errors in storage (in RAM or disk) or transmission. Even/odd parity means that the parity bit is set so that there are an even/odd number of one bits in the word, including the parity bit. Odd parity means that the parity bit is set so that there are an odd number of one bits in the word, including the parity bit.

PPP (Point to Point Protocol) - PPP is the protocol defined in RFC 1661, the Internet standard for transmitting network layer datagrams (e.g., IP packets) over serial point-to-point links.
PPP is designed to operate both over asynchronous connections and bit-oriented synchronous systems, it can configure connections to a remote network dynamically, and test that the link is usable. PPP can be configured to encapsulate different network layer protocols (such as IP, IPX, or AppleTalk) by using the appropriate network.

Protocol - A protocol is a set of formal rules describing how to transmit data across a network. Low level protocols define the electrical and physical standards to be observed, bit- and byte-ordering, and the transmission, error detection and correction of the bit stream. High level protocols deal with the data formatting, including the syntax of messages, the terminal to computer dialogue, character sets, sequencing of messages, etc.

PSTN (Public Switched Telephone Network) - PSTN is the collection of interconnected systems operated by the various telephone companies and administrations (PTTs) around the world.

RFC (Request for Comment) - RFC is a numbered Internet informational documents and standards widely followed by commercial software and freeware in the Internet and UNIX communities.

RIP (Routing Information Protocol) - RIP is the companion protocol to IPX for exchange of routing information in a Novell network. It is not related to the Internet protocol of the same name.

SAP - SAP is the OSI term for the component of a network address that identifies the individual application on a host which is sending or receiving a packet.

SNMP (Simple Network Management Protocol) - SNMP is the Internet standard protocol, defined in STD 15, RFC 1157, developed to manage nodes on an IP network.

SOCKS - SOCKS is a security package that allows a host behind a firewall to use Finger, FTP, Telnet, Gopher, and Mosaic to access resources outside the firewall while maintaining the security requirements.

Spoofing - Spoofing is a technique used to reduce network overhead, especially in a WAN. Some network protocols send frequent packets for management purposes. These can be routing updates or keep-alive messages. In a WAN this can introduce significant overhead, due to the typically smaller bandwidth of WAN connections.
Spoofing reduces the required bandwidth by having devices, such as bridges or routers, answer for the remote devices. This fools (spoofs) the LAN device into thinking the remote LAN is still connected, even though it's not. The spoofing saves the WAN bandwidth, because no packet is ever sent out on the WAN.

SPX (Sequenced Packet Exchange) - SPX is a transport layer protocol built on top of IPX. SPX is used in Novell NetWare systems for communications in client/server application programs, e.g., BTRIEVE (ISAM manager).

Static Station - A static station is a host, which is added manually to an ARP or LAN table.

Stop Bit - Stop Bits mark the end of a unit of transmission (normally a byte or character). In serial communications, where each bit of the message is transmitted in sequence, stop bits are extra "1" bits which follow the data and any parity bit.

Synchronous Transmission - Synchronous transmission is when data bits are transmitted at a fixed rate. The sender and the receiver are synchronized.

TCP (Transmission Control Protocol) - TCP is the most common transport layer protocol used on Ethernet and the Internet.
TCP is built on top of Internet Protocol (IP) and is nearly always seen in the combination TCP/IP (TCP over IP). It adds reliable communication, flow-control, multiplexing and connection-oriented communication. It provides full-duplex, process-to-process connections.
TCP is defined in STD 7, RFC 793.

TCP/IP stack (Transmission Control Protocol over Internet Protocol) -TCP/IP stack is the standard Ethernet protocols incorporated into 4.2BSD UNIX. While TCP and IP specify two protocols at specific layers, TCP/IP is often used to refer to the entire DoD protocol suite based upon these, including Telnet, FTP, UDP and RDP.

TFTP (Trivial File Transfer Protocol) - TFTP is a simple file transfer protocol used for down-loading boot code to diskless workstations.

Throughput - Throughput is the amount of data a communications channel can carry, usually in bytes per second.

UDP (User Datagram Protocol) - UDP is an Internet standard network layer, transport layer and session layer protocols which provide simple but unreliable datagram services. It adds a checksum and additional process-to-process addressing information. UDP is a connectionless protocol which, like TCP, is layered on top of IP.
UDP is defined in STD 6, RFC 768.

WAN (Wide Area Network) - A WAN is a network, usually constructed with serial lines, extending over distances greater than one kilometer.

Index

–A–

AC power connection, 2-5
Accepted PPP Authentication, 5-70
Access control, 5-68
Access Control menu, 5-68, 5-69, 5-70, 5-71, 5-74, 5-77, 5-82, 5-86
Accessible Stations/Nets, 5-70
Advanced Filter
  Defining, 5-79
Advanced filters
  Use of, 5-75
Advanced menu, 4-5, 4-23
  Accessing, 4-23
  Options, 4-23
Advanced Menu
  Setup Menu, 4-21, 4-24, 4-26, 4-29, 4-30, 4-31, 4-32, 4-33, 4-34, 4-35, 5-1, 7-1, 7-2, 7-4, 7-5, 7-10, B-2
Advanced Setup Menu, 5-45, 5-59
Alarm Filter, 7-6
Analog voice specifications, 1-17
AppleTalk, 5-75
Applications, 1-2
Argument, 5-73
ARP Table, 4-33, 4-35
Autolearn Zero LAN IPX Nets, 5-25
Autonegotiation, 5-31

–B–

Backup partition, 4-25
Blocking, 5-76
Boot Manager
  Accessing, B-1
  Duplicate active partition, B-4
  Erase all FLASH, B-4
  Erase configuration, B-4
  Exit, B-5
  Introduction, B-1
  Load new software, B-2
  Main menu, B-2
  Partitions status, B-3
  Reactivate backup partition, B-4
  Run backup partition, B-4
  Set baud rate, B-5
BOOT Manager
  XMODEM via Control Port, 4-27
Bridge, 4-10, 5-12
Bridge Table, 4-31
Bridging support, 1-14

–C–

Cable
  CBL-RJ45/2BNC/E1, 2-2, A-5
  CBL-RJ45/D9/F/6FT, 2-2, 3-4, A-6
Cable types, A-1
Cables necessary for installation, 2-2
Cabling diagrams, A-1
CBL-RJ45/2BNC/E1, 2-2, A-5
CBL-RJ45/D9/F/6FT, 2-2, 3-4
CD, 5-30
CHAP, 5-70
CIR, 5-67
Class, 4-12, 5-5
CLLM, 5-66
Clock, 1-9
Clock distribution, for Ring Redundancy, 1-12
Clock recovery, 1-9, 1-12
COD, 5-82
Code to wait/send, 5-73
Connecting
  AC power, 2-5
  E1 link, 2-3
  T1 link, 2-3
Connection on Demand. See COD
Connection Timeout, 5-30
Connections, 2-3
Connector specifications, A-1
Contact Person, 5-4
Control port connection, 2-4
Control Sequence, 5-73
Controlling access to FCD-IP, 4-16
CTS, 5-30

–D–

Data channel interfaces, 1-9
Data port
  Connection, 2-3
  Interfaces specifications, 1-19
DECnet, 5-75
Default Gateway, 4-13, 5-5
  Configuration, 4-13
Default IP mask, 5-5
Defining Filters, 5-77
delay number, 5-72
Destination, 5-14
Device access restriction, 4-16
Device Name, 5-4
Diagnostic Tools menu, 4-5
Dial-in IPX Net, 5-25
DLCI, 4-11, 5-67
DNS, 5-81

Download
Device parameters from TFTP server, 4-27
New software from TFTP server, 4-25
Dual Image Flash, 4-25
Duplicate active partition, Boot Manager, B-4

–E–

E1
Connector information, A-5
Diagnostics, 7-2
Features, 5-33
Link connection, 2-3
Link interface specifications, 1-16
Settings, 5-31
E1 Setup menu, 5-48
Encapsulation method, 4-11
Environmental characteristics, 1-21
Erase all FLASH, Boot Manager, B-4
Erase configuration, Boot Manager, B-4
Exit, 4-5
Exit, Boot Manager, B-5

–F–

Factory Default menu, 5-88
Factory default options, 5-88
FCD-IP
Physical description, 1-7
FCD-IP
Available versions, 1-1
Features, 1-5
Introduction, 1-1
FCD-IP
Functional description, 1-8
FCD-IP
Installation and setup, 2-1
FCD-IP
Operation, 3-1
FCD-IP
Configuration, 4-1
FCD-IP
Interface specifications and cable diagrams, A-1
FCD-IP
Boot Manager, B-1
FCD-IP
SNMP management, C-1
FCD-IP
Glossary of terms, D-1
Features of FCD-IP, 1-5
Fiber optic interfaces specifications, 1-19
Filter
Advanced filters, 5-75
Defining, 5-77
Tests, 5-77
Firewall, 4-16, 4-18
Flash, 4-25
Forwarding, 5-76
Frame pathway, 5-14
Frame Relay
DLCI parameters, 5-67
Features, 5-63
Implementing, 5-64
Link parameters, 5-64
FTP, 5-81
Full Enquiry Interval, 5-66
Fuse replacement, 2-4

–G–

General Diagnostics, 5-38, 5-52, 7-14, 7-17
getip number, 5-72

–H–

High level, 5-79
Host parameters, 5-2
Host Parameters, 4-20, 5-3

–I–

Inband Management, 4-35
Indicators, 3-1
Normal indications, 3-4
Installation site requirements, 2-1
Installing FCD-IP, 2-1
Interface, 4-5, 4-30
Address, 5-16
Connections, 4-5, 4-30
Parameters. See Interface parameters
Signals list, A-1
Specifications, A-1
Interface parameters
Setup menu, 5-27
Interface Parameters
E1/T1 settings, 5-31
Overview, 5-27
Interface Parameters Menu
ISDN Protocol Settings, 5-61
Interfaces
Setting up, 2-3
Interval parameters, 7-3
Introduction to FCD-IP, 1-1
IP, 4-10
Fragmentation, 5-16
Interfaces, 4-31
Mask, 4-12
Routing Table, 4-31
IP Address, 5-5
Pool setting, 5-17
Translation, 4-21
IP Address Pool, 5-18
IP Compression, 5-13
IP Mask, 5-5
IP Net, 5-15
IP Router, 5-12
IP Routing Settings, 5-19
Interface Address, 5-16
IP Address Pool, 5-18
IP Address Pool setting, 5-17
Link RIP/SAP Mode, 5-25
Maximum Transmit Unit, 5-16
PC remote access, 5-19
RIP Mode, 5-16
IP/IPX router support, 1-14
IP-Station, 5-15
IPX, 4-10
Routing, 4-32
services, 4-32
IPX Net, 5-14

IPX Router, 5-12
ISDN
  Protocol Settings, 5-61
  S interface pin assignments, A-7
  Specifications, 1-19

–K–

Keep Alive (IPX), 5-87

–L–

LAN
  Interface specifications, 1-19
  IP Mask, 4-12
LAN IP Address, 4-12
LAN IP Mask, 4-12
LAN IPX Net for Frame Type, 5-25
LAN Status, 4-12
LCP, 4-11
LEDs. See Indicators
Link
  RIP/SAP Mode, 5-25
  Settings, 5-26
Link characteristics, 1-9
Link Cost/Metric, 5-12
Link Mode, 4-10
Link Protocol, 5-12
Link Status, 4-10
Link Type, 5-12
LMI, 5-64
Load new software, Boot Manager, B-2
Loopback test, 7-14, 7-18

–M–

MAC Address, 5-4
MAC Station, 5-15
Main link connectors information, A-5
Main Menu, 4-5
Management
  connections
    SNMP, 3-6
  Domains under SNMP, C-3
  Overview, 1-15
Management Information Base (MIB). See MIB
Maximum Transmit Unit, 5-16
Mechanical specifications, 1-20
MIB
  Objects, C-2
  Structure, C-2
  Supported MIBs, C-3
MTU, 5-16

–N–

Name, 5-71
Native, 5-12
NCP(s), 4-11
NetBIOS, 5-75

–O–

Operating
  Instructions, 3-1
  Overview, 3-1
Originate only, 5-30

–P–

Package contents, 2-2
PAP, 5-70
Partition, 4-25
Partitions status, Boot Manager, B-3
Password, 5-71
  Changing the password, 4-17
  Default password, 4-17
  Setting a supervisor password, 4-17
PC remote access, 5-19
Polling interval, 5-66
Power
  Connection, 2-4
  Requirements specifications, 1-21
PPP, 4-11, 5-12
PPP Settings, 5-13
Primary partition, 4-25
Protocol, 4-11
Protocol Field Compression, 5-13
Protocols, 1-15

–Q–

Q.933/ANNEX A, 5-64
Quick
  Setup, 4-5
Quick Setup menu
  E1 example, 4-9
  ISDN example, 4-9
  Parameters, 4-6
  T1 example, 4-8

–R–

RADIUS Accounting Port, 5-9
RADIUS Accounting Status, 5-8
RADIUS Authentication Port, 5-9
RADIUS Authenticator, 5-8
RADIUS Server IP Address, 5-8
Reactivate backup partition, Boot Manager, B-4
Redundancy
  main link
    E1/T1 ring, 1-11, 1-12, 1-13
Redundancy, Ring Topology, 1-10
Reset, 4-28
Retransmission Timeout, 5-7, 5-9
Ring Redundancy, 1-10
RIP, 5-81
RIP Mode, 5-16
RIP/SAP Spoofing (IP/IPX), 5-87
Routing, 4-10
  Specifications, 1-19
  Tables, 4-30
RTS, 5-30
Run backup partition, Boot Manager, B-4

–S–

Security
  Access control, 5-68
  Firewall, 4-18
  Overview, 4-5
  Setup, 4-15

SNMP, 4-17
TELNET, 4-17
Security Authentication, 5-70
Security Setup menu, 4-5
send pattern, 5-72
sendhide pattern, 5-72
Set baud rate, Boot Manager, B-5
Setup Menu, 4-21, 4-24, 4-26, 4-29, 4-30, 4-31, 4-32, 4-33, 4-34, 4-35, 5-1, 7-1, 7-2, 7-4, 7-5, 7-10, B-2
Host parameters, 5-2
Host Parameters, 4-20, 5-3
Interface Access Control, 5-68
Interface Parameters, 5-27
WAN Economy, 5-73
Site requirements, 2-1
SNA, 5-75
SNMP
Access, enabling, 4-17
Advanced filter parameters, 5-81
Communities, C-3
connections, 3-6
Environment, C-1
Management, C-1
Management domains, C-3
Message authenticaiton, C-4
Operation types, C-1
Traps, C-6
Software download, 4-24
Solid firewall, 4-16
Specifications, 1-16
Statistics, 7-1
Status, 5-29
STP, 5-12
Sub link
Connectors information, A-5
E1/T1 settings, 5-31
Synchronous, 4-10, 5-29
System
Clock, 1-9
System Location, 5-4

–T–

T1
Connector information, A-5
Diagnostics, 7-2
Features, 5-32
Link connection, 2-3
Link interface specifications, 1-17
Link parameters, 5-37
Settings, 5-31
T1 Setup menu, 5-34
T1.617/ANNEX D, 5-64
TCP/IP network, 4-12
TDM main link
E1/T1 ring, 1-11, 1-12, 1-13
Technical specifications, 1-16
TELNET
Access, enabling, 4-17
Advanced filter parameters, 5-81
Terminal
Type, 4-28
Terminals Server, 5-12
TFTP
Advanced filter parameters, 5-81
Downloading, 4-25
Server, 4-25
Time slot
Handling, 1-10
timeout number, 5-72
Total Timeout, 5-7, 5-9
Traps, SNMP, C-6
True-False menus, 5-80
Turning off the unit, 3-6
Turning on the unit, 3-1
Type, 5-29

–U–

Upload device parameters to TFTP server, 4-27
User Access Profiles, 5-70

–V–

V.36 interface cable, A-4
Versions of FCD-IP, 1-1
View menu, 4-5
Configuration, 4-29
View Menu, 4-30
Interface Connections, 4-30
Routing Tables, 4-30
Voice
Diagnostic tools, 7-17
Diagnostic tools, 7-19

–W–

Waitcase pattern, 5-72
waitnocase pattern, 5-72
WAN
Economy, 5-73
Protocols specifications, 1-19

–X–

X.21 interface cable, A-3
XMODEM, 4-27

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